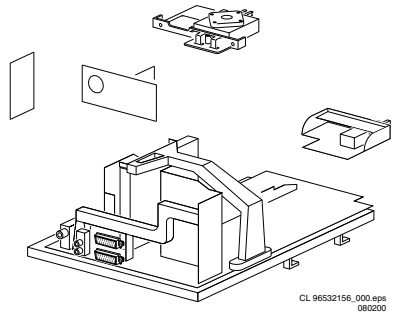
Colour television

Chassis

EM2E

AA

Service
Service
Service



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Service Manual

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PHILIPS

1. Technical specifications, connection facilities and chassis overview

1.1 Technical specifications

1.1.1 Reception

Tuning system	:	PLL
Reception	:	
TV systems off air	:	PAL B/G/I, SECAM B/G/L/L' for Western Europe
	:	PAL B/G, SECAM B/G/D/K, NTSC M for Eastern Europe
Sound systems	:	FM
	:	AM
	:	NICAM B/G/D/K/I
A/V connections	:	PAL B/G/D/K/I
	:	SECAM B/G/D/K/L/L'
	:	NTSC video playback
Channel selections	:	100 channels: VHF, UHF, S-Channels, Hyperband
Frequency range	:	44.25 - 855.25 MHz
Aerial input	:	Coaxial 75Ω
VCR preselections	:	0 and 90 - 99

1.1.2 Miscellaneous

Mains voltage	:	220V - 240V (± 10 %); 50 - 60Hz (± 5 %)
Ambient temperature	:	+5 to +45 deg. Celcius
Standby Power Consumption	:	< 1W

1.2 Connection facilities

1.2.1 Side I/O connections

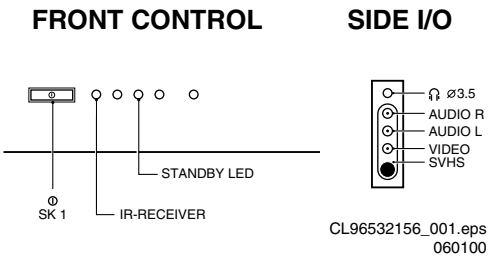


Figure 1-1

Audio / video

- - Video (CVBS)	$1V_{PP}$ / 75Ω	
- - Audio	L ($0.5V_{RMS}$ / 10kΩ)	
- - Audio	R ($0.5V_{RMS}$ / 10kΩ)	
- - Headphone	(32 - 2000Ω / 10mW)	

SVHS

1 -	GND	
2 -	GND	
3 - Y	($1V_{PP}$ / 75Ω)	
4 - C	($0.3V_{PP}$ / 75Ω)	

1.2.2 Rear connections

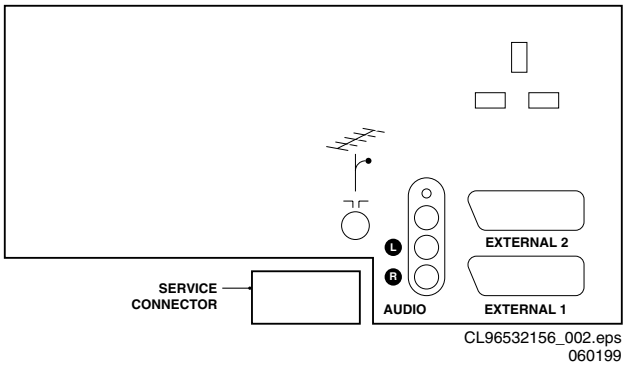


Figure 1-2

Audio

- - Audio	L ($0.5V_{RMS}$ / 10kΩ)	
- - Audio	R ($0.5V_{RMS}$ / 10kΩ)	

External 1 (in/out): RGB+CVBS

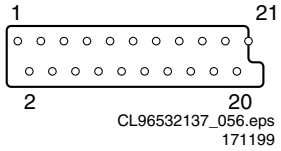


Figure 1-3

1 - Audio	R ($0.5V_{RMS}$ / 1kΩ)	
2 - Audio	R ($0.5V_{RMS}$ / 10kΩ)	
3 - Audio	L ($0.5V_{RMS}$ / 1kΩ)	
4 - Audio	GND	
5 - Blue	GND	
6 - Audio	L ($0.5V_{RMS}$ / 10kΩ)	
7 - Blue	($0.7V_{PP}$ / 75Ω)	
8 - CVBS-status	0 - 1.3V: INT, 4.5 - 7V: EXT 16:9, 9.5 - 12V: EXT 4:3	
9 - Green	GND	
10-		
11- Green	($0.7V_{PP}$ / 75Ω)	
12-		
13- Red	GND	
14- RGB-status	GND	
15- Red	($0.7V_{PP}$ / 75Ω)	
16- RGB-status	0 - 0.4V: INT 1 - 3V: EXT / 75Ω	
17- CVBS	GND	
18- CVBS	GND	
19- CVBS	($1V_{PP}$ / 75Ω)	
20- CVBS	($1V_{PP}$ / 75Ω)	
21- Earth	GND	

External 2 (in/out): SVHS+CVBS (intended for VCR)

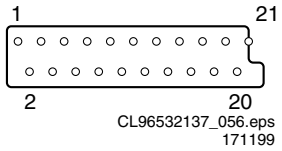


Figure 1-4

1 - Audio	R ($0.5V_{RMS}$ / 1kΩ)	⊖→
2 - Audio	R ($0.5V_{RMS}$ / 10kΩ)	⊖
3 - Audio	L ($0.5V_{RMS}$ / 1kΩ)	⊖→
4 - Audio	GND	⏚
5 -	GND	⏚
6 - Audio	L ($0.5V_{RMS}$ / 10kΩ)	⊖
7 -		
8 - CVBS-status	0 - 1.3V: INT, 4.5 - 7V: EXT 16:9, 9.5 - 12V: EXT 4:3	
9 -	GND	⏚
10-	Easy link	
11-		
12-		
13- Red	GND	⏚
14- RGB-status	GND	⏚
15- C	($0.7V_{PP}$ / 75Ω)	⊖
16-		
17- CVBS	GND	⏚
18- CVBS	GND	⏚
19- CVBS	($1V_{PP}$ / 75Ω)	⊖→
20- Y/CVBS	($1V_{PP}$ / 75Ω)	⊖
21- Earth	GND	⏚

1.3 Chassis overview

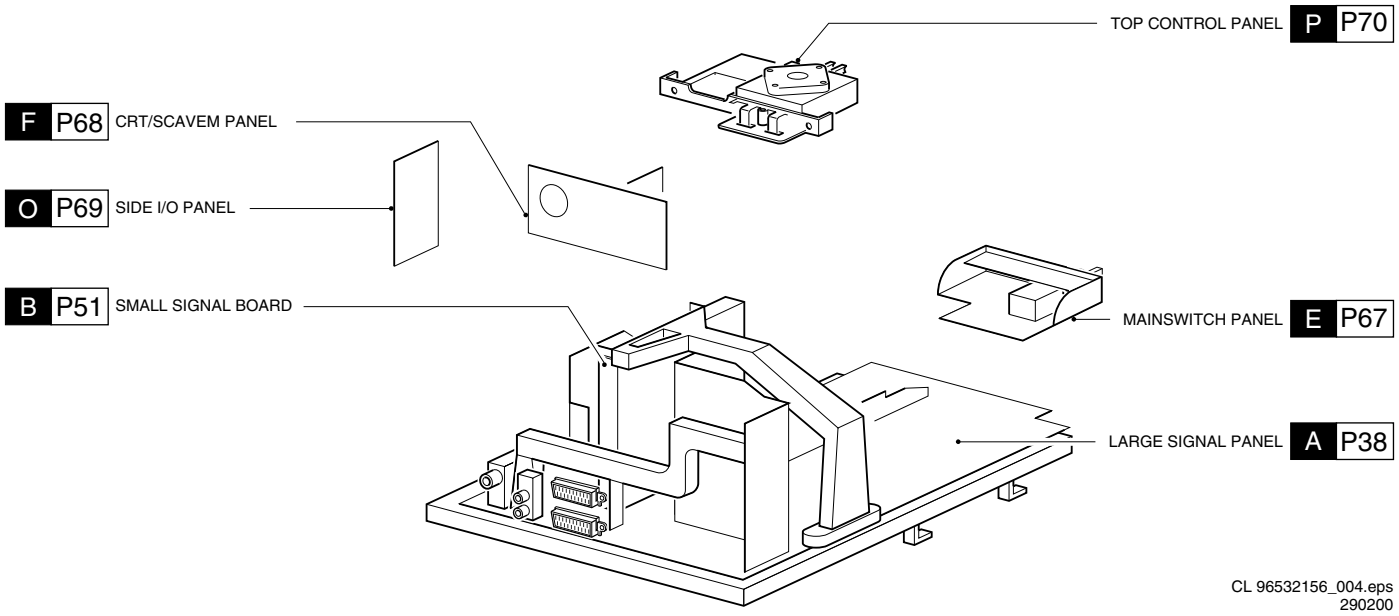


Figure 1-5

2. Safety & Maintenance instructions, Warnings and Notes

2.1 Safety instructions for repairs

Safety regulations require that during a repair:
- Due to the EM2E concept, a very large part of this chassis (incl. Hor. & Vert. deflection) is 'hot'. Therefore the set must be connected to the mains via an isolating transformer.
- Safety components, indicated by the symbol ▲, should be replaced by components identical to the original ones.
- When replacing the CRT, safety goggles must be worn.

Safety regulations require that after a repair, the set must be returned in its original condition. In particular attention should be paid to the following points:
- General repair instruction: as a strict precaution, we advise you to resolder the solder joints, through which the horizontal deflection current is flowing, in particular:
  - All pins of the line output transformer (LOT);
  - Fly-back capacitor(s);
  - S-correction capacitor(s);
  - Line output transistor;
  - Pins of the connector with wires to the deflection coil;
  - Other components through which the deflection current flows.

Note: This resoldering is advised to prevent bad connections due to metal fatigue in solder joints and is therefore only necessary for television sets older than 2 years.
- The wire trees and EHT cable should be routed correctly and fixed with the mounted cable clamps.
- The insulation of the mains lead should be checked for external damage.
- The mains lead strain relief should be checked for its function in order to avoid touching the CRT, hot components or heat sinks.
- The electrical DC resistance between the mains plug and the secondary side should be checked (only for sets which have a mains isolated power supply). This check can be done as follows:
  - Unplug the mains cord and connect a wire between the two pins of the mains plug;
  - Set the mains switch to the 'ON' position (keep the mains cord unplugged!);
  - Measure the resistance value between the pins of the mains plug and the metal shielding of the tuner or the aerial connection on the set. The reading should be between 4.5 MΩ and 12 MΩ.
  - Switch off the TV and remove the wire between the two pins of the mains plug.
- The cabinet should be checked for defects to avoid touching of any inner parts by the customer.

2.2 Maintenance instructions

It is recommended to have a maintenance inspection carried out by a qualified service employee. The interval depends on the usage conditions:
- When the set is used under normal circumstances, for example in a living room, the recommended interval is 3 to 5 years.
- When the set is used in circumstances with higher dust, grease or moisture levels, for example in a kitchen, the recommended interval is 1 year.
- The maintenance inspection contains the following actions:
  - Execute the above-mentioned 'general repair instruction'.
  - Clean the power supply and deflection circuitry on the chassis.
  - Clean the picture tube panel and the neck of the picture tube.

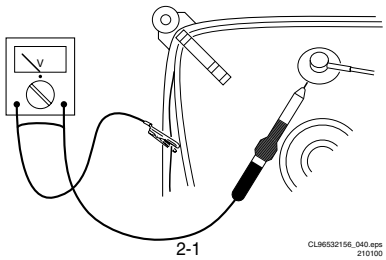
2.3 Warnings

- In order to prevent damage to IC's and transistors, all high-voltage flashovers must be avoided. In order to prevent damage to the picture tube, the method shown in Fig. 2-1 should be used to discharge the picture tube. Use a high-voltage probe and a multimeter (position VDC). Discharge until the meter reading is 0 V (after approx. 30 s).
- All IC's and many other semiconductors are susceptible to electrostatic discharges (ESD). Careless handling during repair can reduce life drastically. When repairing, make sure that you are connected with the same potential as the mass of the set by a wristband with resistance. Keep components and tools also at this same potential.
- Together with the deflection unit and any multipole unit, the used flat square picture tubes form an integrated unit. The deflection and the multipole units are set optimally at the factory. Adjustment of this unit during repair is therefore not recommended.
- Be careful during measurements in the high-voltage section and on the picture tube.
- Never replace modules or other components while the unit is switched ON.
- When making settings, use plastic rather than metal tools. This will prevent any short circuits and the danger of a circuit becoming unstable.
- Wear safety goggles during replacement of the picture tube.

2.4 Notes

- The direct voltages and oscillograms should be measured with regard to the tuner earth (⏚) or hot earth (⏚).
- The direct voltages and oscillograms shown in the diagrams are indicative and should be measured in the Service Default Mode (see chapter 5) with a colour bar signal and stereo sound (L: 3 kHz, R: 1 kHz unless stated otherwise) and picture carrier at 475.25 MHz.
- Where necessary, the oscillograms and direct voltages are measured with (⊓) and without (⊼) aerial signal. Voltages in the power supply section are measured both for normal operation (⏻) and in Standby (⏲). These values are indicated by means of the appropriate symbols.
- The picture tube PWB has printed spark gaps. Each spark gap is connected between an electrode of the picture tube and the Aquadag coating.
- The semiconductors indicated in the circuit diagram and in the parts lists are completely interchangeable per position with the semiconductors in the unit, irrespective of the type indication on these semiconductors.
- Manufactured under license from Dolby Laboratories Licensing Corporation. DOLBY, the double D symbol and PRO LOGIC are trademarks of Dolby Laboratories Licensing Corporation.

DOLBY SURROUND
PRO • LOGIC



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Contents

Installation

Operation

Connect peripheral equipment

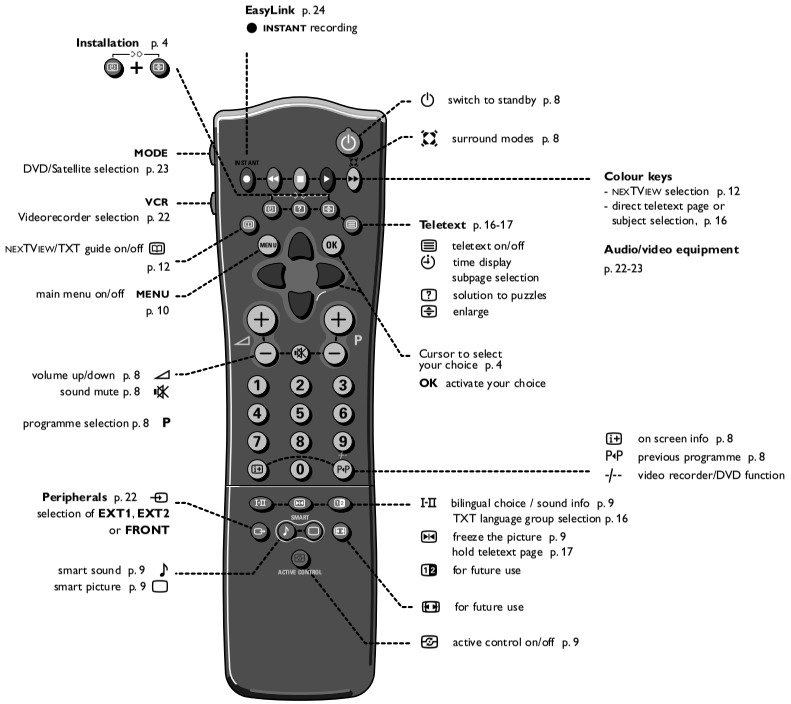
easy LINK

EasyLink features are based on the "one touch operation" approach. This means that a sequence of actions are executed at the same time in both the television and the video cassette recorder, ***provided both are fitted with the EasyLink function*** *and connected with the eurocable supplied with your video recorder.*

English

Preparation

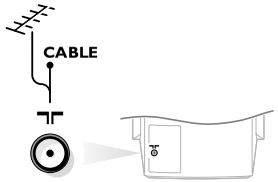
Your remote control



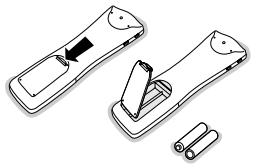
Preparation

1. **Place the TV on a solid surface.**
For ventilation, leave at least 5 cm free all around the TV.
Do not place the TV on a carpet.
To prevent any unsafe situations, do not place any objects on top of the TV.
Avoid heat, direct sunlight and exposure to rain or water.

2. **Insert the aerial plug** firmly into the aerial socket at the back of the TV.



3. Insert the mains plug in the wall socket having a mains voltage of 220V-240V.
To prevent damaging the mains (AC) cord which could cause a fire or electric shock, do not place the TV on the cord.



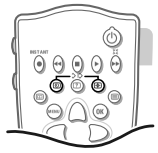
4. Remote control: Remove the cover of the battery compartment.
Insert the 2 batteries supplied (Type R6-1.5V).

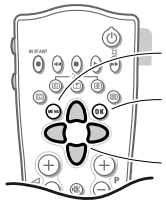
The batteries supplied do not contain the heavy metals mercury and cadmium. Nevertheless in many countries exhausted batteries may not be disposed of with your household waste. Please check on how to dispose of exhausted batteries according to local regulations.

Note: this remote control functions with TVs which use the RC6 signalling standard.

5. **Switch the TV on :** Press the power switch ⏻ on the front of your TV.
A red indicator on the front of the TV lights up and the screen comes on.
If the TV is in standby mode (see p. 8), press the **- P+** key on the remote control.
*When you switch on your set **for the first time**, the menu **LANGUAGE** automatically appears on the screen. The explanation appears in different languages one at a time. Choose your own language and press the **OK** key on the remote control.*

Go on to page 4, Store TV channels.





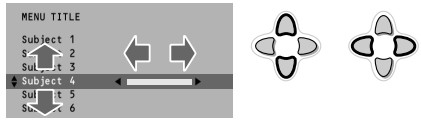
Installation

Select the INSTALLATION menu

Press ⏻ and ⊕ at the same time.

To use the menus

1. Use the cursor in the up/down, left/right directions to select a menu item.
2. Press the **OK** key to activate.
3. Use the **MENU** key to return or to switch the menu off.



Store TV channels

easy LINK

*After the new or extra TV channels have been stored, the TV automatically transfers those TV channels to the video recorder if it is equipped with the EasyLink function. The message **EasyLink : downloading .....** appears on the screen. The programme list of the video recorder is now the same as the one of the TV. If the TV is connected to a video recorder which supports the NEXTVIEWLink function, the TV also automatically transfers the language and country selections to the video recorder.*

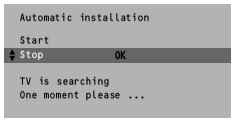
Select the menu language and country

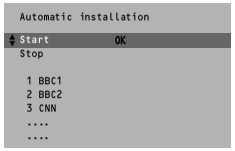
First, select your language and country.

1. Select **Menu language** and press the **OK** key.
2. Select your language and press the **OK** key.
Use the cursor up/down to scroll through the list and to bring up other languages which are not displayed on the screen at present.
3. Select **Country** and press the **OK** key.
4. Select the country where you are now located and press the **OK** key.
Use the cursor up/down to scroll through the list and bring up other countries which are not displayed on the screen at present.

Select **Other** when none of the countries applies.

You can now search for and store the TV channels in two different ways:
using **automatic installation** or **manual installation** (tuning-in channel by channel).
Select your choice and press the **OK** key.





Automatic installation

In the Automatic installation menu select **Start** and press the **OK** key to activate the searching. All TV channels are searched for and stored automatically.

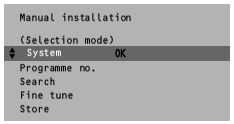
If a cable system which broadcasts ACI (Automatic Channel Installation) or a TV channel transmitting a teletext page with the frequencies and programme names of all the TV channels which can be received, is detected, the search is stopped and a programme list appears.
The programme list is automatically filled with all the programme numbers and names of the TV channels transmitted.

It is possible that the cable company or the TV channel displays a broadcast selection menu. Layout and items are defined by the cable company or the TV channel. Make your choice with the cursor and press the **OK** *key.*

To exit from the menu press the **MENU** key on the remote control.

Go on to page 6.

Manual installation



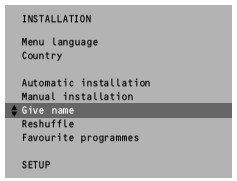
Searching for and storing TV channels is done channel by channel.
You must go through every step of the Manual installation menu.

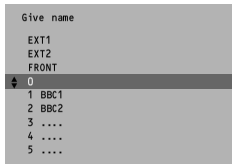
Selection mode is only present and lights up if the country selected also offers the channel option (C-channels for aerial channels, S-channels for cable channels).
You can choose either channel or frequency mode.

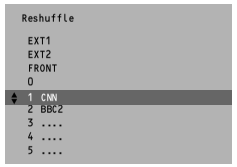
1. Select the TV system
   Select the country or part of the world from where you want to receive the TV channel.
   If you are connected to a cable system, select your country or part of the world where you are now located.
2. Press the cursor down and enter the programme number with the digit keys.
3. Search for a TV channel
   Press the cursor left/right.
   The frequency or the channel number increases until a TV channel is found.

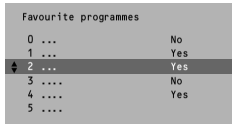
   Direct selection of a TV channel
   If you know the frequency, the C- or S-channel number, enter it directly with the digit keys 0 to 9.
   Ask for a list from your cable company or dealer, alternatively consult the Table of frequencies on the inside backcover of this handbook.
4. Fine tune
   In case of poor reception, you can improve the reception by adjusting the frequency with the cursor left/right.
5. To store your TV channel, select **Store** and press the **OK** key.

   Repeat steps 1 to 5 to store another TV channel.
6. To exit from the menu press the **MENU** key on the remote control.









Give name

It is possible to change the name stored in the memory or to assign a name to a TV channel which has not yet been entered. A name with up to 5 letters or numbers can be given to the programme numbers 0 to 99. For example SUPER, BBC1,... Between 99 and 0 you can also name any peripherals that are connected to a euroconnector.

1. Select **Give name** in the **INSTALLATION** menu and press the **OK** key.
2. Select the programme number.
3. Press the **OK** key.
4. Select the character with the cursor up/down.
5. Select the following position with the cursor right.
6. Select the following character.
7. Press the **OK** key when finished.
8. Press the **MENU** key to return to the **INSTALLATION** menu.

Space, numbers and other special characters are located between Z and A.

Reshuffle the programme list

According to your preference you **can** change the order of the stored TV channels.

1. Select **Reshuffle** in the **INSTALLATION** menu and press the **OK** key.
2. Select the programme number you want to exchange.
3. Press the **OK** key.
4. Select the new number you want to exchange it with.
5. Press the **OK** key.
   Repeat the operation until all TV channels are allocated as you like.
6. Press the **MENU** key to return to the **INSTALLATION** menu.

Select Favourite TV channels

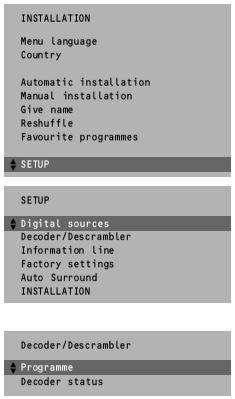
After leaving the installation you can browse through the TV channels by pressing the **- P +** key. Only those TV channels which are in the favourite list will be displayed. Non-favourite TV channels can still be selected with the digit keys. By default all stored channels are added to the favourite list.

1. Select **Favourite programmes** in the **INSTALLATION** menu and press the **OK** key.
2. Select your favourite programme number.
3. Select **Yes** or **No** with the cursor left/right.
4. Repeat for every TV channel you want to make a favourite or a non-favourite TV channel.
5. Press the **MENU** key to return to the **INSTALLATION** menu.

In order for NEXTVIEW to function properly, the first TV channel from the favourite list should also broadcast the correct local date and time via teletext.

Operation

Install TV Setup



The Setup menu allows you to adjust initial settings, i.e. those which are not related to the installation of the TV channels.
The Setup menu contains items that control the settings of the TV's functions, features, services and peripherals you may have connected.

1. Use the cursor in the up/down, left/right directions to select the menu item.
2. Use the **OK** key to activate.
3. Use the **MENU** key to return or switch menu off.

Digital sources
See Connect Peripheral Equipment, p. 20 to connect your digital equipment, like a DVD, a digital satellite tuner or a similar digital device.

Define Decoder/Descrambler programme numbers
If a decoder or a descrambler is connected, see p. 19 you can define one or more programme numbers as decoder programme numbers.

Press the cursor left/right to select the input used to connect to your decoder **Off**, **EXT1** or **EXT2**.
Select **Off** if you do not want the selected programme number being activated as a decoder programme number.

easyLINK

Select **EXT2** *when the decoder is connected to your EasyLink video recorder. When selecting the decoder, the message* ***EasyLink: downloading presets....*** *appears on the screen.*

Information line
Select **On** and after the selection of a TV programme or after pressing the i+ key on the remote control, a TV channel which broadcasts teletext may transmit the name of the TV channel, the programme name or another message. This is displayed on screen next to information about sound.
When selected **Off**, only sound information is displayed after the selection of a TV channel or after pressing the i+ key.

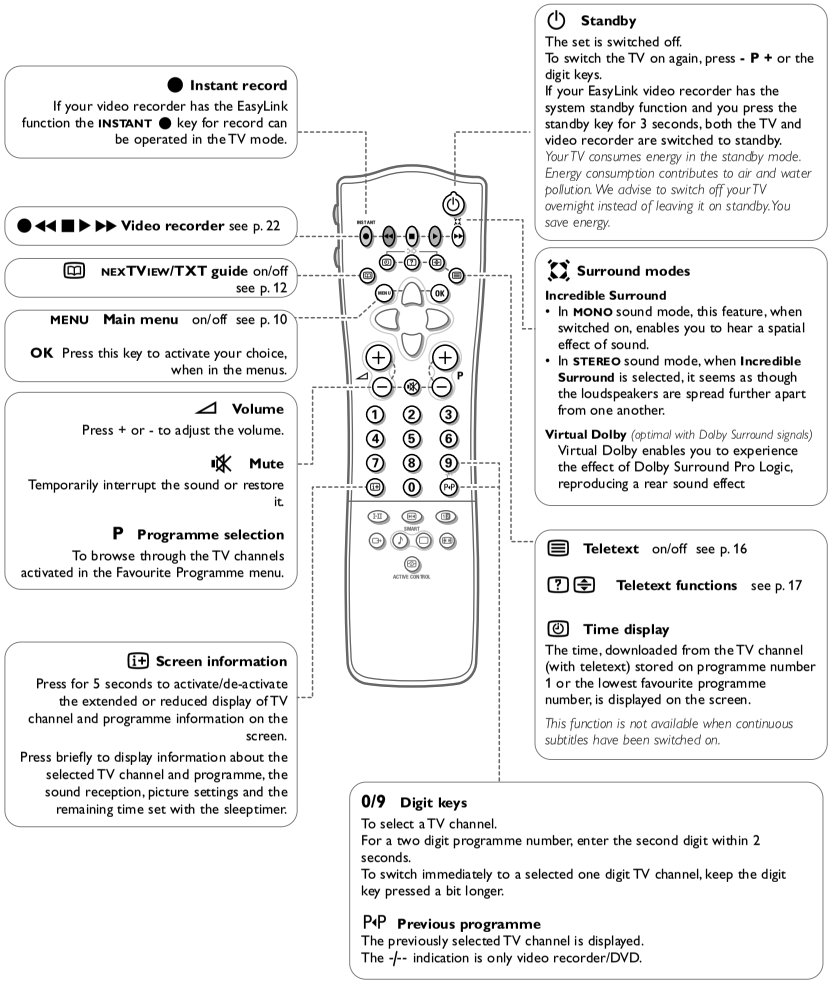
Factory settings
Select **Factory settings** and press the **OK** key to restore picture and sound settings, predefined in the factory.

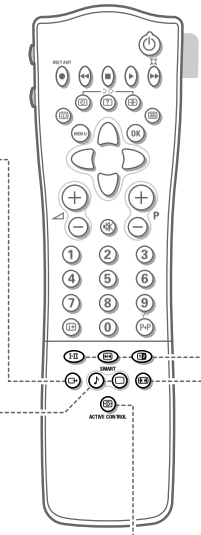
Auto Surround
Sometimes the broadcaster transmits special signals for Surround Sound encoded programmes. In that case, the TV automatically switches to the best Surround Sound mode when Auto Surround is switched on. Virtual Dolby will be reproduced, see p. 8.
Overruling this surround mode remains possible.

Installation
Select **Installation** and press the **OK** key to return immediately to the **INSTALLATION** menu.

4. To exit from the menu press the **MENU** key repeatedly.

Use of the remote control





Select peripherals
Press this key repeatedly to select **EXT1**, **EXT2** or **FRONT**, according to where you connected the peripherals (p. 22).

Smart Keys
To select predefined picture and sound settings.

Smart Sound
Each time it is pressed, a different sound setting is selected, corresponding with specific factory setting of the equalizer.

Smart Picture
Each time it is pressed, a different picture setting is selected, corresponding with specific factory settings of Contrast, Colour, Sharpness and Dynamic Contrast.

Personal refers to the personal preference settings of picture and sound selected in the picture and sound menu.
Remark: the moment you are in a predefined smart sound or picture setting and you modify a setting in the picture or sound menu, all values of the menu will overwrite the previously made settings.

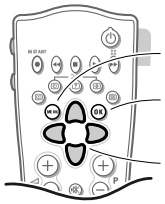
Bilingual choice and sound mode selection
Press this key
- to switch from **Stereo** to **Mono** sound, in case of stereo transmission, or from **Nicam Stereo** to **Nicam available**, in case of digital transmission;
- to choose between language I (Dual I) or language II (Dual II), in case of bilingual transmission. The setting is separately stored for each TV channel.

Freeze
To activate/de-activate the frozen picture or to hold a teletext page.

for future use

for future use

Active control
Active control is a pro-active and automatic system. The TV continuously measures and corrects all incoming signals in order to provide the best picture possible.
Press the key to select the Active Control values Off or On.
Off Sharpness and Dynamic Contrast are controlled automatically
On Sharpness, Dynamic Contrast and Noise Reduction are controlled automatically.
Press the cursor in the up/down directions while the selected Active Control setting information is on top of the screen.
The Active Control menu appears.
The picture settings are being adapted continuously and automatically.
The menu items cannot be selected.
Press the cursor in the up/down directions again to switch off the menu.



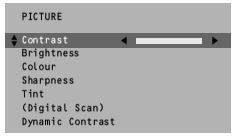
return or switch main menu on/off

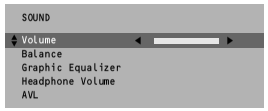
OK key to activate

cursor to select adjustments

Use of the menus

1. Press the **MENU** key to display/cancel the **MAIN MENU**.
2. Use the cursor in the up/down directions to select the **PICTURE**, **SOUND** or **FEATURES** menu or to select the **PROGRAMMES**.
3. Press the cursor right to activate the selected menu.
4. Use the cursor in the up/down, left/right directions to select the menu item.
5. Use the **OK** key to activate.
6. Press the **MENU** key repeatedly to return or to switch the menu off.





Picture menu

If an NTSC peripheral is connected to one of the euroconnectors, the option Hue also appears.

Tint
Select the colour temperature: **Normal**, **Warm** or **Cool**.

Digital Scan (Line Flicker Reduction) *(if provided)*
In certain circumstances while watching TV programmes it may be preferable to switch off the digital scan line flicker reduction.
Press the cursor left/right to select **On** of **Off**.

Dynamic Contrast
To make the contrast in the darker and the brighter picture areas more noticeable, select the **Med** setting.
In certain circumstances it may be preferred to select **Min**, **Max** or **Off**.

The modified adjustments for Contrast, Brightness, Colour, Sharpness, Tint, (Digital Scan) and Dynamic Contrast are automatically stored for all TV channels.
Select **Factory settings** in the Setup menu to restore the predefined factory settings, see p. 7.

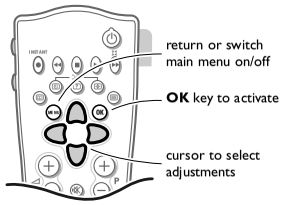
Sound menu

The modified adjustments for Volume, Balance, Treble and Bass are automatically stored for all TV channels.
Select **Factory settings** in the Setup menu to restore the predefined factory settings, see p. 7.

Graphic Equalizer
Here you can select the preferred sound setting which corresponds with the personal sound settings.

Headphone volume
See Connect Peripheral Equipment, p. 21, for the connection of the headphone.

AVL (Automatic Volume Leveller)
AVL automatically controls the volume level to avoid too large level differences, especially when switching to another programme or during commercial breaks.



Features menu

1. Press the **MENU** key to display/cancel the **MAIN MENU**.
2. Use the cursor in the up/down directions to select the **FEATURES** menu.
3. Press the cursor right to activate the selected menu.
4. Use the cursor in the up/down directions to select a menu item.
5. Use the cursor in the left/right directions to select the desired setting.

Sleeptimer

With the sleeptimer you can set a time period after which the TV should switch itself to standby.
The counter runs from **Off** up to **180 min.**
One minute before the TV is set to go to standby, the remaining seconds appear on screen. You can always switch off your set earlier or change the set time.

Child lock

If the child lock is on, the TV can only be switched on with the remote control. The **P** - and + keys on top of the TV cannot be used to select a TV channel. In this way you can prevent unauthorised use of your TV.
If the message **Child lock On** appears, the child lock must be switched off before you can use the **P** - and + keys on top of the TV to select a TV channel.

Subtitle

TV channels with teletext often transmit certain programmes with subtitling. See Teletext, Continuous Subtitles, p. 18 how to select the proper subtitle page from the teletext index.
Select **Subtitle On** or **Off**.

Press the **MENU** key to switch off the Features menu.

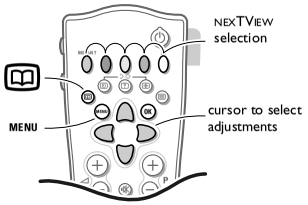
Programme list

1. Press the **MENU** key to display/cancel the **MAIN MENU**.
2. Select **PROGRAMMES** with the cursor up/down.
3. Press the cursor right to display an overview of all the TV channels installed.
4. Press the cursor up/down to run through the list and press **OK** to select the desired TV channel.
5. Press the **MENU** key to switch off the Programme list.

Today, most broadcasters in Europe, are offering teletext pages containing their programme schedule of today. These pages can be requested by switching the TV to **Teletext Guide**.
An increasing number of broadcasters are offering an extended programme guide service called **NEXTVIEW.** NEXTVIEW is a new way of presenting programme schedules and offers more features than common teletext.
With NEXTVIEW it is possible to show for instance all the movies coming tonight.

Both facilities are integrated in this TV: NEXTVIEW and Teletext Programme Guide. If a TV channel supports NEXTVIEW then the TV will automatically present the NEXTVIEW programme schedule. If the TV channel supports just teletext, then the TV will switch automatically to Teletext Guide.
Both facilities are offering the same functions: record, remind and info.
However in case of Teletext Guide the broadcaster is responsible if these functions are possible.
You can search for the programmes you want to watch up to 7 days in advance. It is also possible to search for a programme by theme, e.g. sport, movie, etc. Once a programme has been selected it can be tagged, to remind you, or to record on the video recorder automatically (provided the video recorder is equipped with NEXTVIEWLink, level 2.0), once, daily, weekly or series. Teletext Guide/NEXTVIEW also allows direct access to detailed information about programmes if provided by the broadcaster.

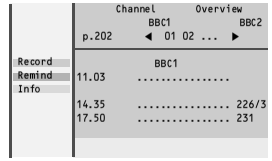
The broadcaster is responsible for the contents of the information.
The TV is responsible for the capture of that information and for the presentation to the user.



Use of the Teletext Guide/NEXTVIEW menus

1. Press the key on the remote control to display/cancel the Teletext Guide/ NEXTVIEW menu.
2. Use the cursor in the up/down, left/right directions to select the date, **CHANNEL** for the channel guide, **THEME** for the theme guide, **OVERVIEW** for an overview of all the programmes which are marked as reminders or for recording, the programme guide page number or to enter the programme list.

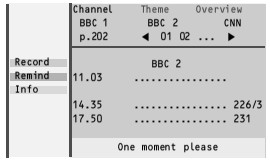
Teletext Guide



3. Enter the proper programme guide page number with the digit keys or with the **– P +** keys.
4. Press the cursor left/right to run through the subpages.
5. Select a programme with the cursor up/down.
6. Press one of the colour keys to select one of the basic functions (if available); **record**, **remind**, **info**. See Basic functions further on.
7. Press the **OK** key to return to the header area again.

NEXTVIEW

3. Select a programme with the cursor up/down.
4. Press one of the colour keys to select one of the basic functions (if available); **record**, **remind**, **info**. See Basic functions further on.
5. Press the **OK** key to return to the header area again.



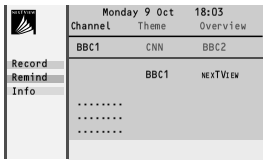
Teletext guide

TV channels which broadcast teletext also transmit a page with the programme guide of the day. For each selected TV channel the programme guide page can be selected with the key:
- automatically if the selected TV channel supports services like PDC (Programme Delivery Control) or MIP (Magazine Inventory Page).
- if automatic pre-selection is not possible then the index page is displayed and the proper programme guide page number of the selected TV channel has to be entered with the digit keys.

The programme guide page will be stored automatically only if it satisfies Video Programming via Teletext (VPT) requirements.

Every time you press the key, the programme guide page of the selected TV channel will be available if the TV channel does not support NEXTVIEW.

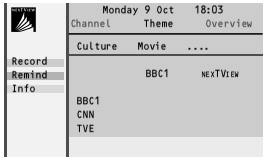
The function items record, remind and info, corresponding with the coloured keys, become highlighted if the displayed programme page satisfies the Video Programming via Teletext (VPT) requirements. Select a programme item and press one of the function keys, e.g. Record or Remind. See Basic functions further on.
The Info item is enabled if the selected programme contains a page number with an optional subcode referring to a page with more info about the programme.



NEXTVIEW modes to sort and represent information

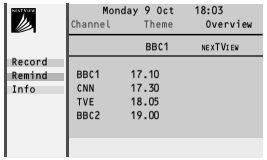
Channel

The Channel guide provides an overview of all programmes that are broadcast by a single channel during one day.
Already passed programmes can be made visible via cursor up.
The list will start with the earliest broadcast programme.
With cursor left/right another favourite TV channel can be selected.



Theme

The theme guide displays a list of all programmes at the selected date, that matches with the selected category (news, sport, culture, movies, …).
The default starting item will be the current or next programme on the current TV channel.
The **THEME** selection is only present if programmes in the TV guide have defined themes.

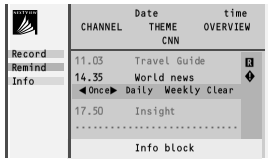


Overview

The Overview menu provides a list of programmes that are marked as reminders or to be recorded each day.
When more than one programme to be recorded has an overlap in time, these programmes will be marked by a red colour.

After the programme has been broadcast, all items set for once will be deleted from the list the following day. This menu can be used to change a reminder or recorder.

Note: the TV will automatically interpret the broadcast time (as shown on the teletext guide) of your selected programme into the correct local time and date.



Basic functions

The functions Record, Remind and Info can be activated with the corresponding colour keys on the remote control.
If the function is not available, then the text is shown at reduced brightness.
Select a programme with the cursor up/down.

Record R or Remind

1. Press the red colour key to activate **Record** or the green colour key to activate **Remind.**
   If the programme number of the broadcaster is not yet known, a message appears with the request to input the correct programme number with the cursor left/right and press OK.
   A small menu pops up in which you can choose the interval: once, daily or weekly, or clear an earlier made record or remind setting. The default interval is set to **Once**. If a programme is an episode of a series, it is identified by the system and the options **daily** and **weekly** are replaced by the option **series**. In this case the system identifies when the next episode of the series will be broadcast. This is not possible in the Teletext guide.
2. Use the cursor in the left/right directions to select the interval.
   The colour of the tag refers to the interval.
3. Press the **OK** key.

When **Record** R is activated:
Storing is displayed to indicate the video recorder is programmed.
When **Remind** is activated:
- a message will be displayed the moment the tagged programme with starts, when watching the TV later on.
- the TV switches on the moment the tagged programme with starts, when the TV is in standby.

Note: Recordings and reminders are not possible when the broadcaster does not transmit dates and times of the programmes.
*The message **No TV programming possible** appears.*
Make sure you are on the TV programming page.

Info

1. Press the yellow colour key to activate **Info**.
   Advertisements or information relating to the selected programme are displayed. In some cases all of the information does not fit on the screen. Use the cursor up/down to browse through all the information.
2. Press the yellow colour key again to switch off the information.

Acquisition and updating of NEXTVIEW information

Acquisition and updating of NEXTVIEW is done when you are watching a TV channel supporting NEXTVIEW.

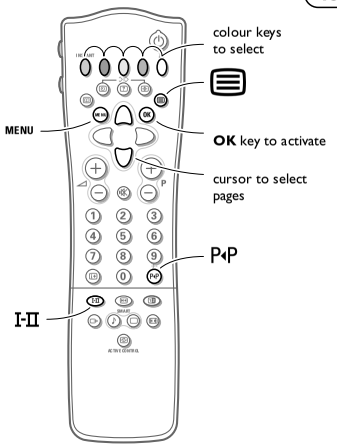
Video recorder restrictions with NEXTVIEW

The **Record** item and the automatic recording will only be present and possible if your video recorder is equipped with NEXTVIEWLink.
Your video recorder should be connected to **EXTERNAL 2**. See Connect Peripheral Equipment, p. 19.

The daily, weekly and series options, the number of recordings set and the way overlapping recordings are managed, depend on the type of video recorder you have. When all video recorder timers are full, the item **Record** in the menu will not be present.

Upload video recorder overview *(only with Philips sets)*
When the TV is switched on, the timer recordings are uploaded to the TV to check if any manual addition or deletions have been done. This is shown in the overview.
The video recorder manages and removes timer recordings when performed.

Some NEXTVIEWLink video recorders do not allow a daily programming of the recording to start on a Saturday or Sunday. In this case the item **daily** will be removed from the menu on those days.



Teletext

Most TV channels broadcast information via teletext.
Each channel which broadcasts teletext transmits a page with information on how to use its teletext system. Look for the teletext page with the main index (usually p. 100).
Depending on the TV channel, teletext is transmitted in different systems.
The colours used in the options line correspond with the colour keys of your remote control.

About Easy Text

Easy Text considerably reduces the waiting time (on condition that the teletext broadcast of the particular TV channel is received for at least half a minute) by :

- a direct selection of previous and following pages which are in transmission and of the pages referred to in the options line
- a habit watcher list: frequently used pages are put automatically in a list of preferred pages, so that they are immediately available
- the precapturing of the page numbers referred to in the displayed page
- the precapturing of all the subpages.

Switch Teletext on and off

Press ☰ to switch the teletext on or off.
The main index page appears on the screen together with two information lines at the top and one option line at the bottom of the screen.

Remark: if the displayed teletext characters on screen do not correspond with the characters used in your language, press the **I-II** *key repeatedly to select Language group 1 or 2.*

Select a Teletext page

With the digit keys
Enter the desired page number with the digit keys.
The page counter seeks the page or the page appears immediately when the page number has been stored in the memory.
A message appears when you have entered a non existent or incorrect page number. Page numbers beginning with 0 or 9 do not exist. Choose another number.

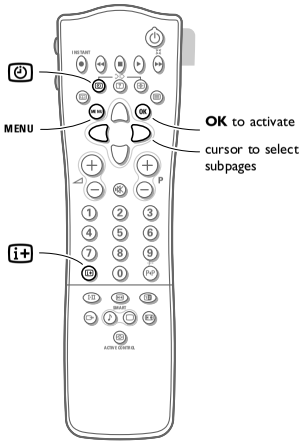
With the option line
Select with the colour keys, corresponding to the coloured options at the bottom of the screen, the desired subject.

Quickly run through the teletext pages

Press the cursor up/down or the **- P +** key to run through the previous or the following pages.

Select the previously selected txt page

Press the P◂P key.



Select the index teletext page

Press the white colour key to display the main index (usually p.100).

Only for T.O.P teletext broadcasts :
T.O.P orders the pages in categories and adds other possibilities of enhancing ease of use.
Press i+. A T.O.P. overview of the teletext subjects available is displayed.
Not all TV channels broadcast T.O.P. teletext. When the teletext system is not T.O.P. teletext, a message appears at the top of the screen.
Select with the cursor up/down, left/right the desired subject and press the **OK** key.

Select subpages

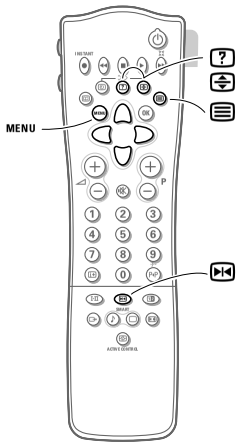
When a selected teletext page consists of different subpages, one of the subpages appears on the screen.
The coloured number in the first information line refers to the displayed subpage.
The other subpages can be selected in 2 ways :

With the cursor left/right
The other subpage numbers appear in white as soon as the transmission has found them. They are stored in the memory so that they are available while the teletext page is on screen.
Select with the cursor left/right the previous or the following subpage.

With the key
• Enter the subpage number yourself:
Press . Enter the desired subpage with the digit keys : e.g. 3 for the third page of seven subpages.
The TV searches for the selected subpage.

• Automatically rotating subpages:
Press again to cancel the entered digit key for the subpage.
Now the subpages rotate automatically.

Press again to select the subpages with the cursor left/right again.



Special teletext functions

Hold
Press to stop the automatically rotating of the subpages or to stop the page counter from seeking when you have entered a wrong page number or when the page is not available.
Enter another page number.

Enlarge
Press repeatedly to display the upper part, the lower part and then to return to the normal page size. When the upper part is displayed, you can scroll the text, line by line using the cursor up/down.

Reveal
Press to reveal/conceal the hidden information, such as solutions to riddles and puzzles.

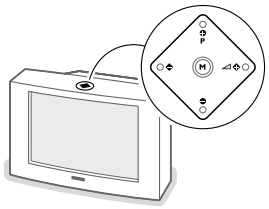
Select Continuous Subtitles

TV channels with teletext often transmit programmes with subtitling. For each TV channel you can store a subtitle page which will be displayed continuously if the programme being broadcast is transmitted with subtitles.

Switch on teletext and select the proper subtitle page from the index.
Switch off teletext.
Now the subtitle page is stored for the selected TV channel.

Once subtitles have been stored and **Subtitle On** has been selected they will automatically be displayed on the selected TV channel if subtitles are in the transmission.
Select **Subtitle On** or **Off** in the Features menu, see p. 11.
The subtitle symbol appears when **Subtitle On** is selected.

Remark: you are in teletext mode, so only teletext functions are available.



Keys on top of the TV

Should your remote control be lost or broken you can still change some of the basic picture settings with the keys on top of the TV.

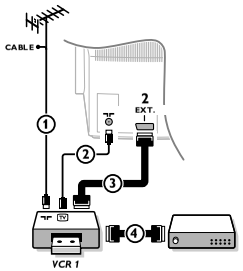
Press the **M** key repeatedly to select **Volume**, **Brightness**, **Colour**, **Contrast**.
Press the **P** - or + keys to carry out the selected adjustment.
When the menu adjustment is not displayed, the **P-** or **+** keys enable you to select the TV channels, the - or + keys to adjust the volume.

The selected adjustment automatically switches off when no action has been executed for 10 seconds.

Connect Peripheral Equipment

There is a wide range of audio and video equipment that can be connected to your TV. The following connection diagrams show you how to connect them.

Video recorder



Connect the aerial cables ①, ② and, to obtain the optimum picture quality, eurocable ③ as shown opposite.

easyLINK

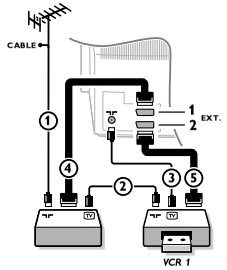
If your video recorder is provided with the EasyLink function, the eurocable supplied with it should be connected to **EXTERNAL 2** *to benefit from the EasyLink functionality.*

If the eurocable ③ is not used the following steps are required:

Search for and store the test signal of the video recorder

1. Unplug the aerial cable ① from the aerial socket ⊤ of your video recorder.
2. Switch on your TV and put the video recorder on the test signal. (See the handbook for your video recorder.)
3. Search for the test signal of your video recorder in the same way as you searched for and stored the TV signals. See Installation, Searching for and storing TV channels, Manual installation, p. 5.
4. Store the test signal under programme number 0 or between 90 and 99.
5. Replace the aerial cable in the aerial socket ⊤ of your video recorder after you have stored the test signal.

Decoder and video recorder
Connect a eurocable ④ to your decoder and to the special euroconnector of your video recorder. See also the video recorder handbook.
See Define Decoder/Descrambler prog. numbers, p. 7.
You can also connect your decoder directly to **EXTERNAL 1** or **2** with a eurocable.

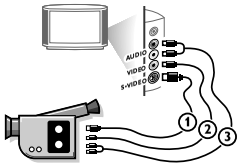


Video recorder and other peripherals (except Digital Sources)

1. Connect the aerial cables ①, ② and ③ as shown opposite. Better picture quality can be obtained if you also connect eurocable ⑤ to **EXTERNAL 2** and a eurocable ④ to **EXTERNAL 1**.
2. Look for the test signal of your peripheral in the same way as you do for a video recorder.

When a video recorder is connected to **EXTERNAL 1** *you can only record a programme from your TV.*
Only when a video recorder is connected to **EXTERNAL 2** *it is possible to record a programme from your TV as well as from other connected equipment. See Record with your video recorder, p. 24.*

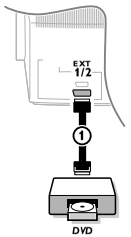
Note: EXTERNAL 1 can handle CVBS and RGB, EXTERNAL 2 CVBS and Y/C.



Camera & camcorder

1. Connect your camera or camcorder to sockets at the right side of your TV.
2. Connect the equipment to **VIDEO** ② and **AUDIO L** ③ for mono equipment.
   Press the I-II key repeatedly to select the sound coming from one or both loudspeakers of your TV.
3. For stereo equipment also connect **AUDIO R** ③.

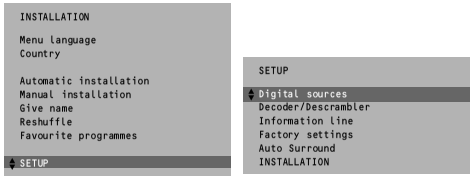
S-VHS quality with an S-VHS camcorder is obtained by connecting the S-VHS cables with the **S-VIDEO** input ① and **AUDIO** inputs ③.



Digital equipment (DVD, digital satellite tuner,...)

Connect your digital equipment with a eurocable ① to one of the euroconnectors (**EXT1** or **EXT2**), or with a cinch cable to the **VIDEO** input at the right side of the TV (see illustration above).

1. Press ⌂ and ⇳ at the same time.



2. Select **Digital sources** in the Setup menu of the **INSTALLATION** menu and select:
   - **None** if you have no digital source connected,
   - **EXT1** or **EXT2** if you have connected your equipment to a euroconnector,
   - **FRONT** in case you have connected your equipment to the right side of the TV.
3. Press the **MENU** key to switch off all menus.

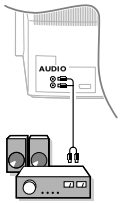
Note: the low quality of some digital picture material may be the cause of digital image distortion. In this case select ***Eco*** *under the* ***SMART PICTURE*** *key on the remote control as this setting is intended to improve distorted picture quality.*

Headphone

1. Insert the plug into the headphone socket at the right side of the TV.
2. Press on the remote control to switch off the internal loudspeakers of the TV.

The headphone impedance must be between 8 and 4000 Ohm.
The headphone socket has a 3.5 mm jack.

In the **SOUND** menu select **Headphone volume** to adjust the headphone volume, see p. 10.



Audio equipment / Amplifier

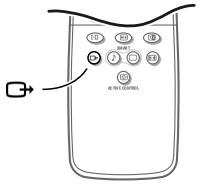
Connect the audio cables to the audio input of your audio equipment and to **AUDIO L** and **R** at the back of your TV.

You can listen to your TV sound via your audio equipment.

If you want to connect more equipment to your TV, consult your dealer.

To select connected equipment

easy LINK



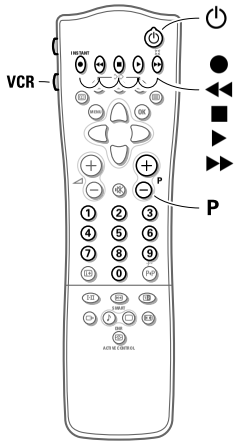
If the TV is connected to a video recorder with the EasyLink function, in some cases the TV will be switched on, even when it was in standby. (E.g. playback tape,...)
This is not possible when Child lock On is selected.

Equipment connected with an aerial cable only :
Select the programme number under which you have stored the test signal with the digit keys.

Equipment connected to a euroconnector or to the right side of the TV
Press the key repeatedly to select **EXT1**, **EXT2** or **FRONT**, according to where you connected your equipment at the back or the right side of your TV.
Remark : Most equipment (decoder, video recorder, satellite receiver) carries out the switching itself.

If you want to change to TV channels?
Enter the programme number of the TV channel which you want to watch with the digit keys or press the key repeatedly to select **TV**.

Audio and video equipment keys



Most of the audio and video equipment from our range of products can be operated with the remote control of your TV.

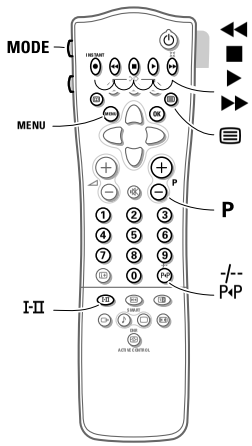
Video recorder
Keep the **VCR** key on the left side of the remote control pressed and simultaneously press:

●	for record,
◀◀	for rewind,
■	for stop,
▶	for play,
▶▶	for fast forward,
-/--	for selecting 1- or 2-digit programme numbers from the video recorder,
- P +	for sequential programme selection from the video recorder tuner,
0 to 9	to select a programme number from your video recorder tuner,
⏻	to switch the video recorder to standby

These keys function with equipment which use the RC5 signalling standard.

easy LINK

If your video recorder has the EasyLink function, the key **INSTANT** ● *for recording, can be operated in the TV mode.*
If your EasyLink video recorder has the system standby function, when you press the ⏻ key for 3 seconds, both TV and the video recorder are switched to standby.



Satellite receiver

Press the **OK** key simultaneously with the digit key 1.
Now you can operate your satellite receiver with the remote control of your TV.

Keep the **MODE** key on the left side of the remote control pressed and simultaneously press:

MENU to switch the **SAT** menu on or off
-/-- to select a one or two digit programme number from the satellite receiver.

These keys function with equipment which use the RC5 signalling standard.

DVD player

Press the **OK** simultaneously with the digit key 2.
Now you can operate your DVD player with the remote control of your TV.

Keep the **MODE** key on the left side of the remote control pressed and simultaneously press:

MENU to switch the DVD menu on or off
to select a DVD title
P•P to select a DVD chapter
I-II to select your choice of audio language
◀◀ to search down
■ stop
▶ play
▶▶ to search forward
0-9 to select a programme number from your DVD
OK to enter the selected menu item

●, , , , have no function

Note: after replacing the batteries the default operational equipment is the satellite receiver.

These keys function with equipment which use the RC6 signalling standard.

Record with your video recorder

To record S-VHS quality, connect an S-VHS peripheral directly to the video recorder.

Record a TV programme

1. Select the programme number on your video recorder.
2. Set your video recorder to record.
   See the handbook for your video recorder.

Switching programme numbers on your TV does not disturb recording !

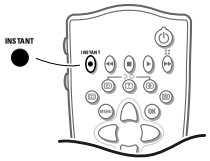
Record a programme on your video recorder connected to EXTERNAL 2 from Audio/Video equipment connected to EXTERNAL 1 or to sockets on the right side of the TV

1. Switch on the equipment.
2. Select the right external on your video recorder.
3. Set your video recorder to record.
   You record what you are watching on the screen.

Do not switch programme numbers or do not switch off your TV when you are recording !

Record with your video recorder with EasyLink

easy LINK



If you have connected an S-VHS video recorder provided with the EasyLink function, you can record S-VHS-quality from an S-VHS peripheral connected to the right side of the TV. (E.g. from an S-VHS camcorder.)

In TV mode, it is possible to start a direct recording of the programme which is being displayed on the TV screen.
Press the **INSTANT** ● *record key of the remote control.*
The video recorder switches on from standby and a message of what is being recorded appears on the screen.
The video recorder starts recording the programme you are watching.
Switching programme numbers on your TV does not disturb recording !

When recording a programme from a peripheral connected to EXTERNAL 1 or FRONT, you can not select another TV programme on the screen.
To watch TV programmes again, press the programme number you want to select twice.
Attention: the recording is stopped and your video recorder switches to standby.

Record with your video recorder with NEXTVIEWLink

If your video recorder is equipped with NEXTVIEWLink, and you tagged one or more programmes to be recorded automatically in the NEXTVIEW mode, it is not necessary for the TV to be in the standby mode or switched on for the recording to start.

4. Mechanical instructions

4.1 Accessing the service connector (for ComPair)

1. Remove the 'Service Connector' cover, see Figure 4.1.
2. Connect the ComPair cable (for more info see chapter 5).
3. Start ComPair and perform the diagnosis.

4.2 Removing the Rear Cover

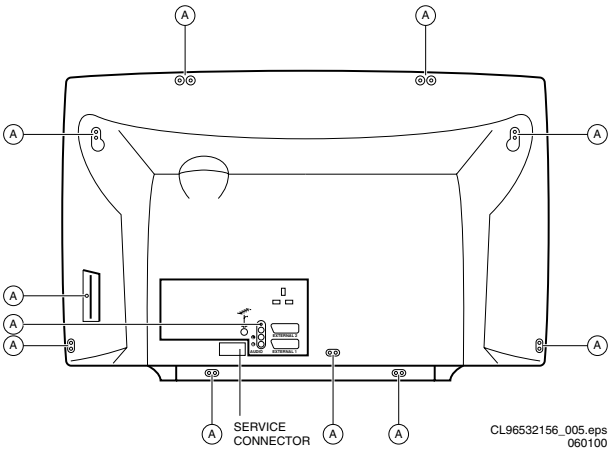


Figure 4-1

1. Remove the fixation screws (A) of the rear cover, notice also the screw for the side-I/O.
2. Now the rear cover can be removed.

4.3 Service position

The following PWB's are present in this chassis (see also 'Chassis overview', chapter 1):

1. Large Signal Panel (LSP)
2. Small Signal Board (SSB)
3. Top Control panel
4. CRT panel (or PTP)
5. Side I/O panel
6. Mains Switch/LED panel

4.3.1 Service position LSP

Position 1: For better accessibility of the LSP, do the following (figure 4.2):

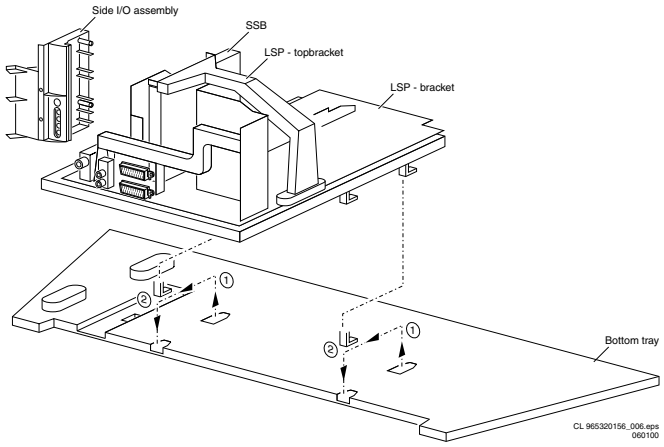


Figure 4-2

1. Remove the LSP-bracket from the bottom tray by pulling it backwards.
2. Hook the bracket in the first row of fixation holes of the bottom tray. In other words reposition the bracket from (1) to (2).

Position 2: To get access to the bottom side (solder side) of the LSP, do the following (figure 4.3):

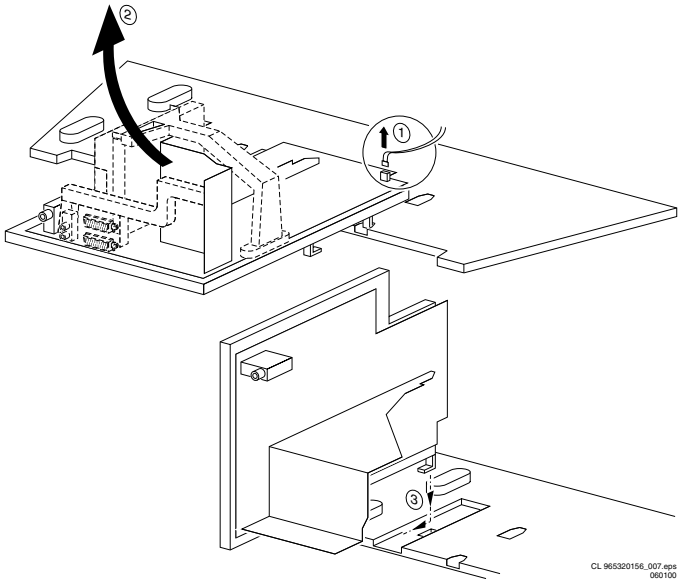


Figure 4-3

1. Disconnect the degaussing coil from the LSP by removing the cable on connector 0020 (1).
2. Release the wiring from the heatsink fixation clamps, in order to get room for repositioning the LSP.
3. Turn the LSP 90 degrees clockwise (2) and place it in the fixation hole at the left side of the bottom tray (3).

4.3.2 Service position SSB

In fact there is no predefined service position for the bottom (B-) side of the SSB. All relevant test points are located on the A-side (side that is facing the Tuner).
If IC's must be replaced: take the complete panel out of the SIMM-connector.
To get access to the SSB test points, do the following:

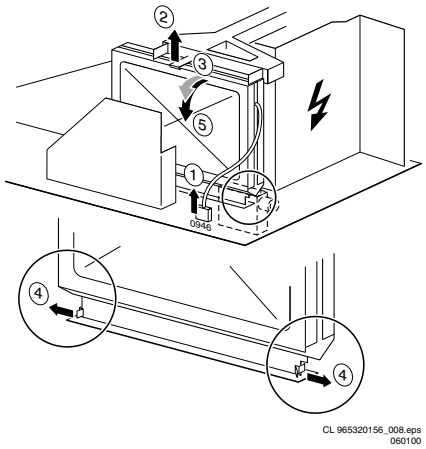


Figure 4-4

1. Put the LSP in service position 1 (as described above).
2. Disconnect the IF-cable from connector 0946 (1).
3. Release the 'top fixation clamp' which holds the SSB (2) and pull the SSB slightly towards the Tuner (3). At the same time, the 2 metal clamps at both sides of the SIMM-connector must be released (4) and the complete SSB can be taken out now by pulling the top-side of the SSB towards the Tuner (5). It 'hinges' in the SIM-connector.

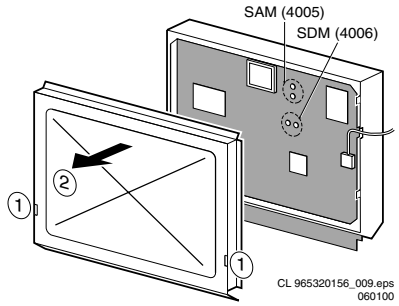


Figure 4-5

1. Once the SSB has been taken out of the connector, the A-side shielding can be removed.
2. After removal of the shielding, the panel can be replaced in its connector in reverse order. Don't forget to reconnect the IF-cable.
3. If necessary for the measurement, the LSP can be put in 'service position 2' (as described above).

4.3.3 Accessing the Top Control panel

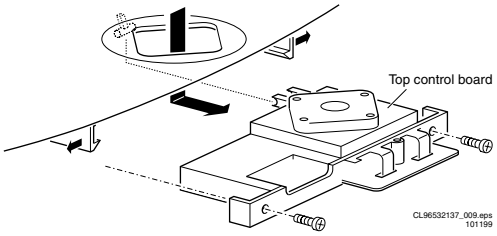


Figure 4-6

1. Remove the two screws.
2. Pull the board backward.

4.3.4 Accessing the Side I/O panel

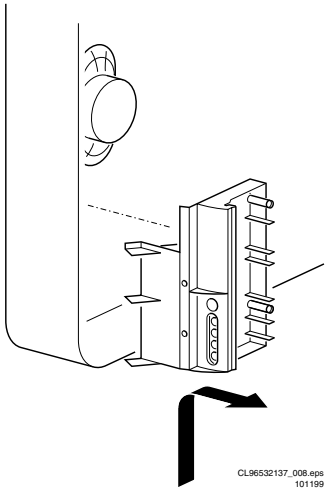


Figure 4-7

1. The complete Side I/O-assembly can be lifted out of the hinge for servicing.
2. The board can easily be removed out of the bracket by releasing the fixation clamps.

4.3.5 Accessing the Mains Switch/LED panel

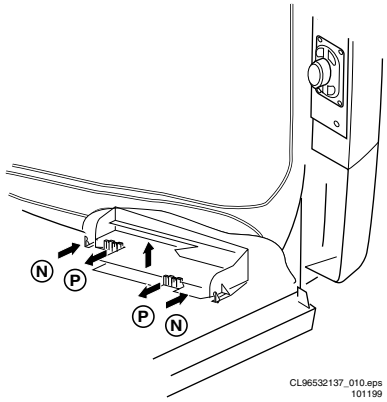


Figure 4-8

1. Release the two fixation clamps (N) by pushing them upward.
2. At the same time, the complete assy must be pulled backward (P).
3. If necessary, the light guide can be replaced now.
4. The 'Mains Switch/LED'-panel can be removed now by releasing the clamps of the bracket.

4.4 Mounting the Rear Cover

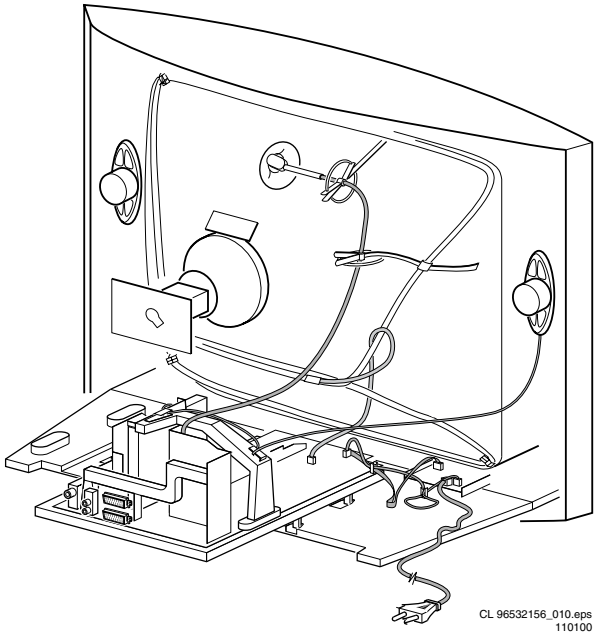


Figure 4-9

Before mounting the Rear Cover, some checks has to be performed:

- Check whether the Mains Cord is mounted correctly in the guiding brackets.
- Check whether all cables are replaced in their original position. This is very important due to the large 'hot' area of the set. Special attention must be paid to the right Loudspeaker cable and the degaussing cable.

5. Service modes, error codes, protections, faultfinding and repair tips

In this chapter the following paragraphs are included:
1. Test points.
2. Service modes.
3. Problems and solving tips (related to CSM).
4. ComPair.
5. Error codes.
6. Protections.
7. Repair tips.

5.1 Test points

The EM2E chassis is equipped with test points in the service printing. These test points are referring to the functional blocks:
- P1-P2-P3, etc. on LSP: Test points for the power supply.
- L1-L2-L3, etc. on LSP: Test points for the line drive and line output circuitry.
- F1-F2-F3, etc. on LSP: Test points for the frame output circuitry.
- R1-R2 on LSP: Test points for the rotation circuitry.
- A1-A2-A3, etc.: Test points for the audio circuitry.
- I1-I2-I3, etc. on SSB:Test points for the Tuner/IF part.
- S1-S2-S3, etc. on SSB: Test points for the synchronisation circuitry.
- V1-V2-V3, etc. on SSB: Test points for the video processing circuitry.
- C1-C2-C3, etc. on SSB: Test points for the control and teletext circuitry.
- F1F-F2F-F3F, etc.: Test points for the CRT-panel circuitry.
- SC1-SC2-SC3, etc: Test points for the SCAVEM circuitry.

The numbering is done in a for diagnostics logical sequence; always start diagnosing within a functional block in the sequence of the relevant test points for that functional block.

5.2 Service modes and ComPair

5.2.1 Service Default Mode (SDM)

The purpose of the SDM is to provide a situation with predefined settings to get the same measurement results as given in this manual.

Specification of the SDM:
- Tuning frequency 475.25 MHz.
- TV-system for BGLM sets set to BG.
- All picture settings at 50 % (brightness, colour, contrast, hue).
- All sound settings at 50 % except volume at 25 % (so bass, treble, balance at 50 %, volume at 25 %).
- All service-unfriendly modes are disabled (like sleep timer, child lock, blue mute, AVL and SDLP).

Entering the SDM can be done in 4 ways:
- Via a standard RC-handset by entering the code '062596' followed by the 'MENU' button (it is possible that, together with the SDM, the main menu will appear. To switch it off, push the 'MENU' button again).
- Via ComPair.
- By the 'DEFAULT' button on the DST while the set is in the normal operation mode.
- By short-circuiting for a moment the two solder-pads with the indication 'SDM' (item 4006) on the A-side of the SSB (activation can be performed in all modes except when the set has a problem with the main-processor).

Note: If the SDM is entered via the pins, all the software-controlled protections are de-activated.

Exiting the SDM can only be done via the STANDBY command. By switching off-on the set with the mains switch the set will come up again in the SDM.

5.2.2 Service Alignment Mode (SAM)

The purpose of the SAM is to align the set and/or adjust the settings.

Specification of the SAM:
- Software alignments (see chapter 8).
- Option settings (see chapter 8).
- Error buffer reading and erasing. The most recent error code is displayed on the left side.
- Operation counter.
- Software version.

Entering the SAM can be done in 4 ways:
- Via a standard RC-handset by entering the code '062596' followed by the 'OSD' button [i +] (it is possible that, due to the button sequence, the channel will change to channel 9. To return to the channel of your selection, push the appropriate button on the RC).
- Via ComPair.
- By the 'ALIGN' button on the DST while the set is in the normal operation mode (or SDM). Enter the password '3140' and press OK.
- By short-circuiting for a moment the two solder-pads with the indication 'SAM' (item 4005) on the A-side of the SSB (activation can be performed in all modes except when the set has a problem with the main-processor).

Note: If the SAM is entered via the pins, all the software controlled protections are de-activated.

The Service Alignment Mode menu will now appear on the screen. The following information is displayed:
- Date: the software date.
- ID: the software version of the ROM (Example: EM2E11.0_01501. This software-code stands for EM2E (chassis), E = Europe, 1 = language, 1.0 = software version, xxxxx = latest 5 digits of 12nc code software).
- Operation Hours: the accumulated total of operation hours.
- Errors: followed by maximal 10 errors. The most recent error is displayed at the upper left. For explanation errors see (table 5.1).
- Defect. Module: here the module that generates the error is displayed. If there are multiple errors in the buffer that have not all been generated by a single module, there is probably another defect. The message 'Unknown' will then be displayed here.
- Reset Error Buffer: pressing the 'OK' key can reset the error buffer.
- Functional Test: all devices are tested via the 'OK' key. Eventual errors are displayed in the error buffer. The error buffer is not erased, the content returns when the Functional Test is terminated.
- Alignments: this enables the Alignments sub-menu to be called up.
- Dealer Options: extra features for dealers.

Exiting the SAM can be done via the 'MENU' command or via switching OFF-ON the set with the mains switch.

5.2.3 Customer Service Mode (CSM)

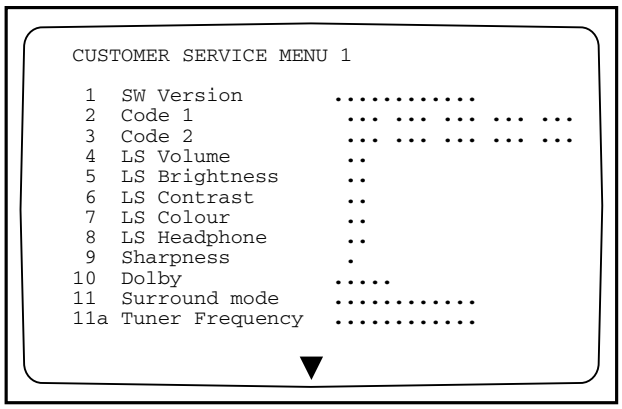
All EM2E sets are equipped with the 'Customer Service Mode' (CSM). This 'Customer Service Mode' is a special service

mode, which can be activated and deactivated by the customer upon request of the service technician/dealer during a telephone conversation in order to identify the status of the set. This CSM is a 'read only' mode, therefore modifications in this mode are not possible.

Switching-on of the Customer Service Mode:
The Customer Service Mode will switch-on after pressing simultaneously the 'MUTE' knob on the remote control handset and the 'MENU' button on the TV for at least 4 seconds. This activation only works if there is no menu on the screen.

Switching-off the Customer Service Mode:
The Customer Service Mode will switch-off after pressing any key of the remote control handset (with exception of the 'cursor-up' and 'cursor-down' keys), or the buttons on the TV or by switching off the TV set with the mains switch.

Detailed explanation of the Customer Service Mode
After switching on the Customer Service Menu the following screen will appear:



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101199

Figure 5-1

Note: Following text is an explanation of the CSM. Be aware that these descriptions are depending on the set hardware.

Line 1:
Software version; the build in software version (AAABCX.Y)
- AAA = chassis name (EM1 = Painter processor, EM2 = OTC processor)
- B = country (E = Europe, A = Asian Pacific, U = USA)
- C = 1 (language cluster)
- X = main version number
- Y = sub version number

Details on the software version can be found in the chapter 'Software Survey' of the publication 'Product Survey - Colour Television'.

Line 2:
Code 1; gives the last 5 errors of the error buffer. As soon as the built-in diagnose software has detected an error the buffer is adapted.

Line 3:
Code 2; gives the first 5 errors of the error buffer. As soon as the built-in diagnose software has detected an error the buffer is adapted.
The last occurred error is displayed on the leftmost position of code 2. Each error code is displayed as a 3 digit number. When less than 10 errors occur, the rest of the line(s) is (are) empty. In case of no errors the text 'No Errors' is displayed. See paragraph 5.5 of this chapter for a description of the error codes.

Line 4:
LS Volume; gives the Last Status of the volume as set by the customer for this selected transmitter. The value can vary from 0 (volume is minimum) to 24 (volume is maximum). Volume values can be changed via the volume key on the remote control handset.

Line 5:
LS Brightness; gives the Last Status of the brightness as set by the customer for this selected transmitter. The value can vary from 0 (brightness is minimum) to 63 (brightness is maximum). Brightness values can be changed via the 'cursor left' and 'cursor right' keys on the remote control handset after pressing the 'MENU' button and selecting 'PICTURE' and 'Brightness'.

Line 6:
LS Contrast; gives the Last Status of the contrast as set by the customer. The value can vary from 0 (contrast is minimum) to 63 (contrast is maximum). Contrast values can be changed via 'cursor left' and 'cursor right' keys on the remote control handset after pressing the 'MENU' button and selecting 'PICTURE' and 'Contrast'.

Line 7:
LS Colour; gives the Last Status of the colour saturation, as set by the customer. The value can vary from 0 (colour is minimum) to 63 (colour is maximum). Colour values can be changed via 'cursor left' and 'cursor right' keys on the remote control handset after pressing the 'MENU' button and selecting 'PICTURE' and 'Colour'.

Line 8:
LS Headphone; gives the Last Status of the headphone volume, as set by the customer. The value can vary from 0 (volume is minimum) to 24 (volume is maximum). Headphone volume values can be changed via the 'cursor left' and 'cursor right' keys on the remote control handset after pressing the 'MENU' button and selecting 'SOUND' and 'Headphone'.

Line 9:
Sharpness; gives the sharpness value. The value can vary from 0 (sharpness is minimum) to 7 (sharpness is maximum). In case of bad antenna signals a too high value of the sharpness can result in a noisy picture. Sharpness values can be changed via the 'cursor left' and 'cursor right' keys on the remote control handset after pressing the 'MENU' button and selecting 'PICTURE' and 'Sharpness'.

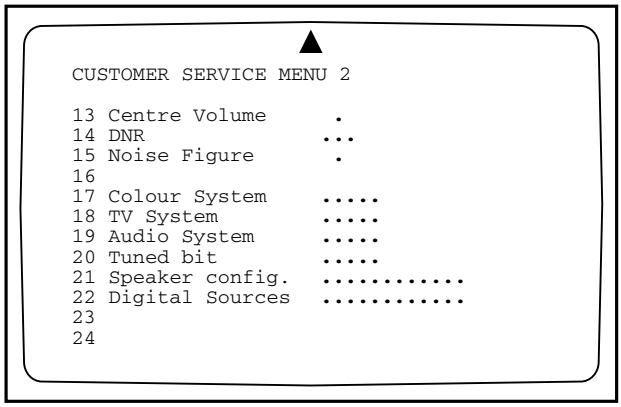
Line 10:
Dolby; indicates whether the received transmitter transmits Dolby sound (present) or not (not present). Attention: The presence of Dolby can only be tested by the software on the Dolby Signalling bit. If a Dolby transmission is therefore received without a Dolby Signalling bit, then this indicator will show 'not present' even though such a Dolby transmission is received.

Line 11:
Surround Mode; indicates the by the customer selected surround mode. In case the set is a Non-Dolby set there will be displayed '0'. If it is a Dolby-set then is displayed: 'Pro Logic', 'Dolby 3 Stereo', 'Hall' or 'Off'. For Dolby-set surround mode can be changed via the 'cursor left' and 'cursor right' keys on the remote control handset after pressing the 'MENU' button and selecting 'SOUND' and 'Surround settings'.

Line 11a:
Tuner Frequency; indicates the frequency the selected transmitter is tuned to. The tuner frequency can be changed via the “cursor left” and “cursor right” keys for fine tune or by entering directly with the digit keys 0 to 9 on the remote control

handset after opening the installation menu and selecting “manual installation”.
The installation menu can be opened by pressing “timer” and “enlarge” at the same time.

By means of the 'cursor-down' knob on the remote control handset the Customer Service Menu 2 will appear. By means of the 'cursor-up' knob on the remote control handset the Customer Service Menu 1 will appear again.
Customer Service Menu 2 represents following information:



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210100

Figure 5-2

Line 13:
Centre Volume; gives the volume value of the centre loudspeakers. This value can vary from 0 (minimum volume) to 63 (maximum volume). Centre volume can be changed via the 'cursor left' and 'cursor right' keys on the remote control handset after pressing the 'MENU' button and selecting 'SOUND', ‘Dolby Pro Logic’ and 'Centre volume'. This feature is only available when surround mode is in 'Dolby Pro Logic' or 'Dolby 3 Stereo'.

Line 14:
DNR; gives the setting of the DNR for the selected transmitter. The following selections are possible:
'off', 'min', 'med' or 'max'. The DNR is changed automatically when 'Active Control' is 'ON'.

Line 15:
Noise Figure; gives the noise ratio for the selected transmitter. This value can vary from 0 (good signal) to 127 (average signal) and to 255 (bad signal).

Line 16:
Digital Option; gives the selected digital mode, '100 Hz' or 'Digital Scan'. Digital option can be changed via the 'cursor left' and 'cursor right' keys on the remote control handset, after pressing the "MENU' button and selecting 'PICTURE', 'Digital Options'.

Line 17:
Colour System; gives information about the colour system of the selected transmitter.
- Black and white: No colour carrier received
- PAL: PAL signal received
- SECAM: SECAM signal received
- NTSC: NTSC signal received

Line 18:
TV System; gives information about the video system of the selected transmitter.
- BG: BG signal received
- DK: DK signal received
- I: PAL I signal received
- L: SECAM L signals received
- M38.9: NTSC M signal received with video carrier on 38.9 MHz
- MN: NTSC M signal received

Line 19:
Audio System; gives information about the audio system of the selected transmitter.
- Sound Muted: No sound
- Dolby Pro Logic: Dolby Pro Logic sound received
- Mono: Mono sound received
- Stereo: Stereo sound received
- Dual I: Language I received
- Dual II: Language II received
- Digital Mono: Digital mono sound is received
- Digital Stereo: Digital stereo sound is received
- Digital Dual I: Digital language I is received
- Digital Dual II: Digital language II is received

Line 20:
Tuned bit; gives information about the tuning method of the stored pre-set. If the value is 'Yes' the pre-set is stored via manual entry of the frequency when a transmitter was not present on that frequency. In that case the TV will attempt to perform a micro-search every time the pre-set number is selected. Once the micro-search has been successful the Tuned Bit will be set to 'No'.

Line 21:
Speaker config.; gives the configuration setting for the speakers. In case the set is a Non-Dolby set there will be displayed '0'. If it is a Dolby-set then is displayed: 'Full internal', 'L/R external', 'Surround external' or 'Full external'. For the Dolby-set the speaker configuration can be changed via the 'cursor left' and 'cursor right' keys on the remote control handset after opening the installation menu and selecting 'SETUP'. The installation menu can be opened by pressing 'timer' and 'enlarge' at the same time. This feature is only available when the set has virtual Dolby.

Line 22:
Digital Sources; gives the configuration setting for the digital source. This can be 'FRONT', 'EXT1', 'EXT2' or 'None'. If one of these is selected the starting point is a top quality signal on that input and a number of settings are therefore changed automatically. The digital source can be changed via the 'cursor left' and 'cursor right' keys on the remote control handset after opening the installation menu and selecting 'SETUP'. The installation menu can be opened by pressing 'timer' and 'enlarge' at the same time.

5.3 Problems and solving tips

Below described problems are all related to TV-settings. The procedures to change the value or the status of the different settings are described in the paragraph ‘Detailed explanation of the Customer Service Mode’.

5.3.1 Picture problems

Worse picture quality in case of DVD pictures
Check line 22 'Digital sources'. In case line 22 gives the indication 'Not Present' change the setting into 'Present'.

Snowy/noisy picture
1. Check line 15 'Noise Figure'. In case the value is 127 or higher and the value is also high on other programs check the aerial cable/aerial system.

2. Check lines 9 'Sharpness' and 15 'Noise Figure'. In case the value of line 9 is 3 or 4 and the value of line 15 is high (127 or higher), lower the value of line 9 'sharpness'.

Picture too dark
1. Press 'Smart Picture' button on the Remote Control handset. In case picture improves, raise the brightness value or raise the contrast value. The new value(s) are automatically stored for all TV channels.
2. After switching on the Customer Service Mode the picture is OK. Raise the brightness value or raise the contrast value. The new value(s) are automatically stored for all TV channels.
3. Check lines 6 'LS Brightness' and 7 'LS Contrast'. The value of line 6 is low (<10) or the value of line 7 is low ((10). Raise the brightness value or raise the contrast value.

Picture too bright
1. Press 'Smart Picture' button on the Remote Control handset. In case picture improves, reduce the brightness value or reduce the contrast value. The new value(s) are automatically stored for all TV channels.
2. After switching on the Customer Service Mode the picture is OK. Reduce the brightness value or reduce the contrast value. The new value(s) are automatically stored for all TV channels.
3. Check lines 6 'LS Brightness' and 7 'LS Contrast'. The value of line 6 is high (>40) or the value of line 7 is high ((50). Reduce the brightness value or raise the contrast value.

White line around picture elements and text
1. Press 'Smart Picture' button on the Remote Control. In case picture improves, reduce the sharpness value. The new value(s) are automatically stored for all TV channels.
2. After switching on the Customer Service Mode the picture is OK. Reduce the sharpness value. The new value(s) are automatically stored for all TV channels.
3. Check line 8 'Sharpness'. Reduce the sharpness value. The new value(s) are automatically stored for all TV channels.

No picture
Check line 20 'Tuned bit'. In case the value is 'Yes', install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation.

Blue picture
No proper signal is received. Check the aerial cable/aerial system.

Blue picture and/or unstable picture
A scrambled or decoded signal is received.

Black and white picture
Check line 5 'LS colour'. In case the value is low ((10) raise the value of colour. The new value(s) are automatically stored for all TV channels.

No colours/colour lines around picture elements
1. Check lines 17 'Colour System' and 18 'TV System'. In case line 17 is 'PAL' and line 18 is 'M38.9', the installed system for this pre-set is 'USA', while 'West Europe' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; West Europe'.
2. In case line 17 is 'PAL' and line 18 is 'L', the installed system for this pre-set is 'France', while 'West Europe' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; West Europe'.

No colours/noise in picture
1. Check lines 17 'Colour System' and 18 'TV System'. In case line 17 is 'Black and White' and line 18 is 'BG', the installed system for this pre-set is 'West Europe', while 'USA' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; USA'.
2. In case line 17 is 'Black and White' and line 18 is 'L', the installed system for this pre-set is 'France', while 'USA' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; USA'

Colours not correct
Check lines 17 'Colour System' and 18 'TV System'. In case line 17 is 'PAL' and line 18 is 'L', the installed system for this pre-set is 'France', while 'West Europe' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; West Europe'.

Colours not correct/unstable picture
Check lines 17 'Colour System' and 18 'TV System'. In case line 17 is 'SECAM' and line 18 is 'BG', the installed system for this pre-set is 'USA', while 'France' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; France'.

Unstable picture
Check lines 17 'Colour System' and 18 'TV System'. In case line 17 is 'SECAM' and line 18 is 'M 38,9', the installed system for this pre-set is 'West Europe', while 'France' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; France'.

Menu text not sharp enough
1. Press 'Smart Picture' button on the Remote Control handset. In case picture improves, reduce the contrast value. The new value(s) are automatically stored for all TV channels.
2. After switching on the Customer Service Mode the picture is OK. Reduce the contrast value. The new value(s) are automatically stored for all TV channels.
3. Check line 7 'LS Contrast'. The value of line 7 is high (>50). Reduce the contrast value.

5.3.2 Sound problems

No sound from left and right speaker
1. Press 'Smart Sound' button on the Remote Control handset. In case sound improves, raise the volume value. The new value(s) are automatically stored for all TV channels.
2. After switching on the Customer Service Mode the volume is OK. Raise the volume value. The new value(s) are automatically stored for all TV channels.
3. Check line 4 'LS Volume'. The value is low. Raise the value of 'Volume'. The new value(s) are automatically stored for all TV channels.

Sound too loud for left and right speaker
1. Press 'Smart Sound' button on the Remote Control handset. In case sound improves, reduce the volume

value. The new value(s) are automatically stored for all TV channels.
2. After switching on the Customer Service Mode the volume is OK. Reduce the volume value. The new value(s) are automatically stored for all TV channels.
3. Check line 4 'LS Volume'. The value is high. Reduce the value of 'LS Volume'. The new value(s) are automatically stored for all TV channels.

5.4 ComPair

5.4.1 Introduction

ComPair (Computer Aided Repair) is a service tool for Philips Consumer Electronics products. ComPair is a further development on the DST service remote control allowing faster and more accurate diagnostics. ComPair has three big advantages:

- ComPair helps you to quickly get an understanding how to repair the EM2E in short time by guiding you step by step through the repair procedures.
- ComPair allows very detailed diagnostics (on I^2C level) and is therefore capable of accurately indicating problem areas. You do not have to know anything about I^2C commands yourself; ComPair takes care of this.
- ComPair speeds up the repair time since it can automatically communicate with the EM2E (when the micro processor is working) and all repair information is directly available. When ComPair is installed together with the SearchMan EM2E electronic manual, schematics and PWB's are only a mouse-click away.

ComPair consists of a Windows based fault finding program and an interface box between PC and the (defective) product. The ComPair interface box is connected to the PC via a serial or RS232 cable. In case of the EM2E chassis, the ComPair interface box and the television communicate with each other via a bi-directional service cable.

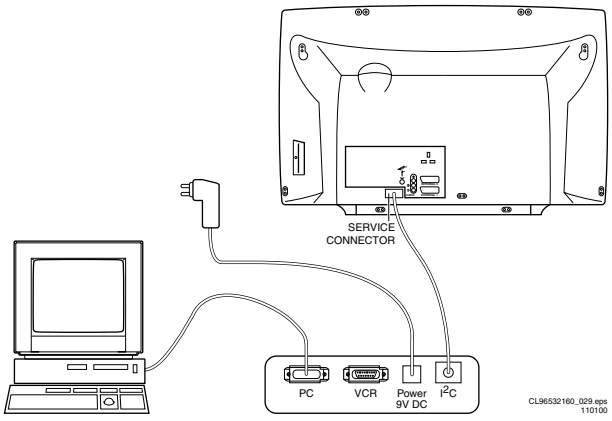

Figure 5-3

The ComPair fault finding program is able to determine the problem of the defective television. ComPair can gather diagnostic information in 2 ways:

1. Communication to the television (automatic)
2. Asking questions to you (manually)

ComPair combines this information with the repair information in its database to find out how to repair the EM2E.

Automatic information gathering

Reading out the error buffer, ComPair can automatically read out the contents of the entire error buffer.
Diagnosis on I^2C level. ComPair can access the I^2C bus of the television without a physical connection. ComPair can send and receive infrared commands to the micro controller of the television. These commands are translated by the controller to I^2C commands and vice versa. In this way it is possible for ComPair to communicate (read and write) to devices on the I^2C busses of the EM2E.

Manual information gathering

Automatic diagnosis is only possible if the micro controller of the television is working correctly and only to a certain extend. When this is not the case, ComPair will guide you through the fault finding tree by asking you questions and showing you examples. You can answer by clicking on a link (e.g. text or an oscillogram) that will bring you to the next step in the faultfinding process.

A question could be: Does the screen give a picture? (Click on the correct answer) YES / NO
An example can be: Measure test point I7 and click on the correct oscillogram you see on the oscilloscope

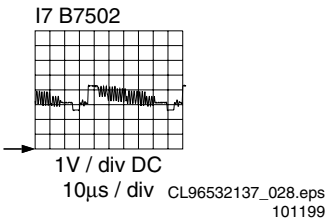

Figure 5-4

By a combination of automatic diagnostics and an interactive question/answer procedure, ComPair will enable you to find most problems in a fast and effective way.

Additional features

Beside fault finding, ComPair provides some additional features like:

- Uploading/downloading of pre-sets
- Managing of pre-set lists
- Emulation of the Dealer Service Tool

5.4.2 SearchMan (electronic service manual)

When ComPair is installed in combination with SearchMan, all schematics and PWB's will be directly available while you repair a television if you click on a PWB or schematic link.
Example: Measure the DC voltage on C2568 (PWB/schematic) on the small signal level.
Clicking on PWB will automatically pop-up a picture of the PWB with the location of C2568 marked. Clicking on schematic will automatically pop-up the schematic with the location of C2568 marked.

5.4.3 Stepwise Start-up / Shutdown feature of set can be used via ComPair

Under normal circumstances, a fault in the power supply or an error during start-up will switch the television to protection-mode. ComPair can take over the initialisation of the television. In this way it is possible to distinguish which part of the start-up routine (hence which circuitry) is causing the problem.

Stepwise start-up explanation
Via ComPair the stepwise start-up can be realised. This is very helpful when a protection is activated (see also chapter 5.6).

State	Description mode	Display LED (Red)	Activate protection
0	Low Power Standby: 5V2/3V3 present, uP in Standby.	On	None
1	High Power Standby: TV-set in Standby.	Wait 1s, flash 1 time	None
2	Main Power On: 5V/ 8V present, HOP in Standby.	Wait 1s, flash 2 times	4, 5
3	HOP On: EHT startup, blackcurrent stabilisation off, picture blanked.	Wait 1s, flash 3 times	Plus 6, 2 & 1
4	Initialised. All IC's are initialised, blackcurrent stabilisation is on.	Wait 1s, flash 4 times	Plus rest
5	TV On: TV-set operates, unblanked picture.	Wait 1s, flash 5 times	

Stepwise shutdown explanation
In the stepwise shutdown mode, state 2 is skipped. (IC's can not be de-initialised).

State	Description mode	Display LED (Red)	De-activate protect.
5	TV On: TV-set operates, unblanked picture.	Wait 1s, flash 5 times	-
4	Initialised. All IC's stay initialised, blackcurrent stabilisation is on.	Wait 1s, flash 4 times	-
3	HOP On: EHT startup, blackcurrent stabilisation off, picture blanked.	Wait 1s, flash 3 time	6, 2, 1
1	High Power Standby: TV-set in Standby.	Wait 1s, flash 1 time	4, 5
0	Low Power Standby: 5V2/3V3 present, uP in Standby.	On	

Note: When set is in stepwise-mode and due to stepping-up a protection is activated, the set really will go into protection (blinking red led). The set will not leave the stepwise-mode however. By stepping up the set can be activated again, until state X, where protection was activated. At state (X-1) diagnostic measurements can be performed.

5.5 Error codes

5.5.1 Reading error codes from the error buffer

The error buffer can be read in 3 ways:

1. On the screen via the Service Alignment Mode (SAM). In case picture is OK, the error buffer can be read easiest via the SAM. In the main menu of the SAM the last 10 different error codes occurred are displayed. The most recent detected error code is displayed on the left side, so e.g.:
   – 0 0 0 0 0 means no error codes present in the buffer
   – 3 0 0 0 0 means one error code present in the buffer; error code 3
   – 2 3 0 0 0 means two error codes present in the buffer; error code 2 is the most recent, error code 3 is detected before 2.
2. Via the blinking LED procedure. The contents of the error buffer can also be made visible through the “blinking LED” procedure. This is especially useful when there is no picture. There are two methods:
   – When the SDM is entered, the LED will blink the number of times, equal to the value of the last (newest) error code (repeatedly).
   – Via the 'DIAGNOSE' key of the DST. If an error has been detected by the EM2E chassis, the set might go into protection. Without the presence of a picture, the errors can be displayed via the red LED on command of the DST, as long as the main-processor is still active. To display the errors via the red LED by the DST:
     1. Press the 'DIAGNOSE' key (in all modes except the SAM).
     2. Press '1' to view the last error detected (or '2', etc. to show the errors before).
     3. Press the 'OK' key. The blinking Red LED on the TV will now give the requested error.

        Example:
        Error code position 1 - 2 - 3 - 4 - 5
        Error buffer: 12 - 9 - 5 - 0 - 0

        After entering SDM: blink 1x long (750 ms for tens) - pause (1.5 s) - blink 8 x short (250 ms for units) - etc.
        After transmitting 'DIAGNOSE-2-OK' with the DST: blink 9 x short - pause (250 ms) - blink 9 x short - etc.
        After transmitting 'DIAGNOSE-3-OK' with the DST: blink 5 x short - pause (250 ms) - blink 5 x - etc.
        After transmitting 'DIAGNOSE-4-OK' with the DST: nothing happens
3. Via ComPair.

5.5.2 Clearing the error buffer

The error buffer can be cleared in 3 ways:

1. In the SAM by selecting the item 'RESET ERROR BUFFER' in the main menu.
2. By the 'DIAGNOSE 99' command of the DST (in all modes except the SAM). Press the DIAGNOSE key on the DST, followed by 9, 9 and then 'OK'.
3. Via ComPair.

Note: When error buffer is full (10 codes), no new error can be stored anymore. However of every error raised is monitored how long it exists in the error buffer. When for any reason a false raised error exists in the buffer, it will be deleted after 50 hours. If this error is still present after 50 hours, it will be raised again. In this way it is safeguarded that the error codes history is stored. Sometimes it is an option to first write down the error buffer content, reset the buffer, and look again which error codes are generated by the set.

5.5.3 Error code table

Error	Device	Description	Defective item	Diagram	Defect. module indication
1	ST24E32	NVM	7011	B5	Control
2	H fail protection	HFB			Horizontal Flyback
3	SAA4978	PICNIC	7709	B3	Feature Box
4	Supply 5 V	5V2			+5 V Supply
5	Supply 8 V	8V6			+8 V Supply
6	Slow I^2C-bus blocked				Slow I^2C blocked
7	TDA9330	HOP video control/geometry	7301	B4	Video Controller
8	TDA9320	HIP I/O-video processing	7323	B2	Chroma IF IO
9	X-ray protection			A3	
11	HOP protection				
12	Tuner protection	TUNER_PROT			+8 V (Tuner) Supply
13	UV1316	Tuner	U1200	A7	Tuner
14	MSP3451/3415	ITT sound processor + Dolby	7651	B6	Audio Module
15	Flash protection				
16	Featurebox protection	FBX_PROT			

Remark:If on the DST the text 'ERROR 2' is displayed, this means that the communication from the TV to the DST has failed.

5.6 Protections

5.6.1 General

The EM2E has only one micro-processor (OTC) which remains active during Standby. This because power of the microprocessor and the attached memory chip set is coming from the 3V3 supply, which is derived from the 5V Standby-circuitry. So in both Power-on as in Standby-mode the microprocessor is connected to this power supply.

If a fault situation is detected an error code will be generated and if necessary the set will be put in the protection-mode. The protection-mode is indicated by blinking of the red LED at a frequency of 3 Hz. In some error cases the micro processor does not put the set in the protection-mode. The error codes of the error buffer can be read via the service-menu (SAM), the blinking LED procedure or via DST/ComPair. The DST diagnose functionality will force the set into the Service-standby, which is alike the usual Standby, however the micro-processor has to remain in normal operation completely.

To get a quick diagnosis the EM2E has 3 service-modes implemented:
- The Customer Service Mode (CSM).
- The Service Default Mode (SDM). Start-up of the set in a predefined way.
- The Service Alignment Mode (SAM). In this mode items of the set can be adjusted via a menu and with the help of test patterns.

Both SDM & SAM modes can be entered via the 'service pads' on the SSB, via a RC (DST or standard RC) or via ComPair. The SAM can not be entered in Standby, the set has to be in normal operation.

The EM2E 'Protection Diagram' shows the structure of the protection system. See diagram below.

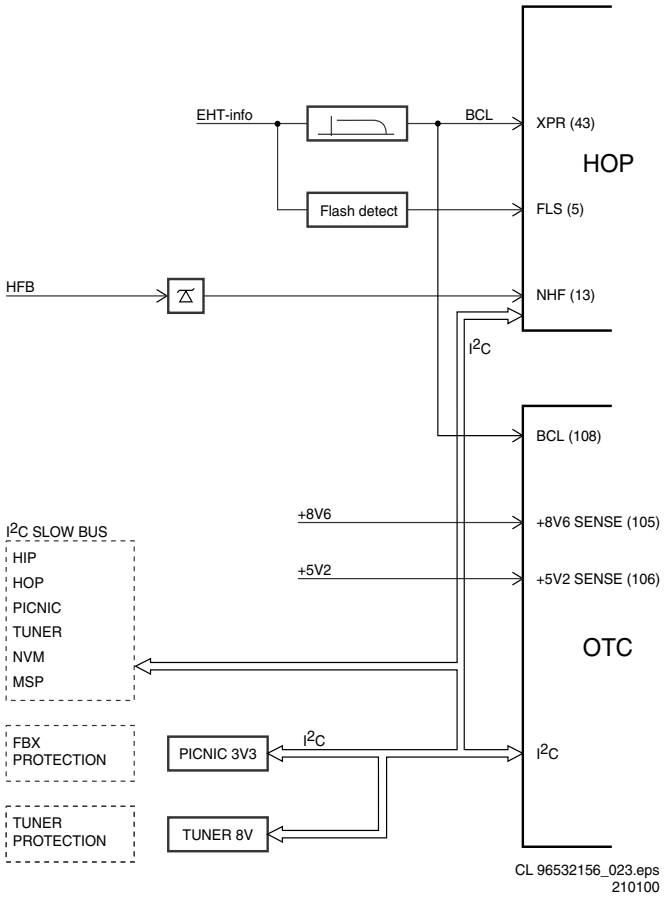

Figure 5-5

There are several types of protections:
- I^2C related protections
- OTC related protections (via polling on I/O pins or via algorithms).
- HOP related protections (mainly for deflection items).
- Hardware errors which are not sensed by the OTC (e.g. BRIDGE_PROT)

I^2C related protections

In normal operation some registers of the I^2C controlled IC's will be refreshed every 200 msec. During this sequence the I^2C-busses and the I^2C -IC's as well will be checked. The I^2C

protection will take place if the SDA and SCL are whether short circuited to ground or to each other. An I^2C error can also occur, if the power supply of the IC is missing (e.g. TUNER_PROT (error 12) & FBX_PROT (error 16)).

OTC related protections

If a protection is detected at an input of the OTC, all protection inputs of the OTC will be scanned every 200 msec. for 5 times. If the protection on one of the inputs is still activated after 1 sec., then the set will be put in the protection-mode. Before the scanning is started a so-called ESD-refresh will be carried out first, because the interrupt on one of the inputs may be caused either by a FLASH or by ESD. As a FLASH or ESD can harm the settings of some IC's, the HOP-HIP-MSP-PICNIC-NVM and Tuner are initialised again to ensure the normal picture and sound conditions of the set.

- 8.6 V and 5.2 V protection. The presence of the 8.6 V and 5.2 V is sensed by the OTC. If these voltages are not present, then an error code is stored in the error buffer of the NVM, and the set is put in the protection-mode.

HOP related protections

Every 200 msec. the status register of the HOP is read by the OTC via I^2C. If a protection signal is detected on one of the inputs of the HOP, then the relevant error bit in the HOP register is set to ‘high’. If the error bit is still ‘high’ after 1 sec., the OTC will store the error code in the error buffer (NVM) and depending on the relevancy of the error bit the set will either go into the protection-mode or not.

- HFB: Horizontal Flyback. If the horizontal flyback is not present, then this is detected via the HOP (HFB_X-RAY_PROT). One status bit is set to ‘high’. The error code is stored in the error buffer and the set will go into the protection mode
- Flash detection. From the EHT-info, via D6303 and T7303 a flash will stop the H-drive and line output stage immediately. The FLS-bit in the status register of the HOP is set to ‘high’. As the duration of a flash is very short the FLS-bit will be reset to ‘low’ again after the flash refresh, so via a slow start the set will be started again.

Hardware related protections

Due to the architecture (with 'hot' deflection) there are two protections that are 'unknown' to the microprocessor, namely the 'BRIDGE_PROT' from the line-stage and the 'NO_VFB' protection form the frame-stage. If one of these protections is triggered, the set is positioned in ‘Standby’-mode. The OTC will now try to re-start the set. If this will not succeed after 5 times (after ≈ 1 minute), the OTC will generate error 15 (Flash protection) and will start the blinking red LED.

5.7 Repair tips

5.7.1 General

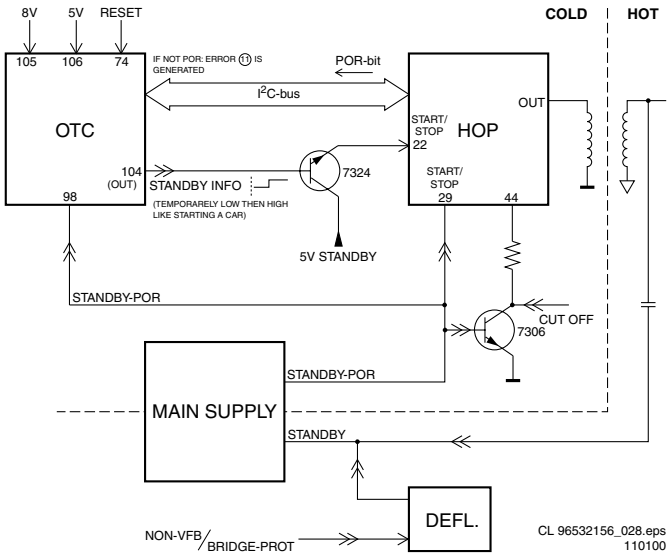

Figure 5-6

The start-up of the set is very different as of other sets:

1. When the set is switched 'ON', first the HOP is placed in 'low power start-up' mode (HOP-standby-mode). This means that 5 V (derived from available Standby-supply) is connected to pin 22 of the HOP-IC.
2. Now the HOP is driving the line-circuitry with 50 kHz pulses. At the base of the line-transistor this is sensed via the 'STANDBY'-line.
3. This signal triggers the Main supply to operate. Now the line-stage has 'BAT'-voltage (141 V), it will also start.
4. After the 5 and 8 V-supply lines are sensed by the OTC, it will read the POR-bit from the HOP via the I^2C-bus.
5. Now the HOP is switched in 'ON'-mode and the set will start-up further with normal drive (31.25 kHz for PAL).
6. The last step will be the unblanking of the picture.

SO STANDBY IS NOT CONTROLLED VIA A STANDBY-LINE FROM MICROPROCESSOR, BUT IS ACHIEVED INDIRECTLY VIA THE HOP-CIRCUITRY.

Notice that a very big part of the set (Large Signal Panel) is 'hot', meaning the primary part of the Standby supply, the whole Main supply (except for the secondary Audio supply) and the complete deflection circuit. SO NOTICE THAT THE DEFLECTION-COIL IS HOT!

This set does not have an IR transmitting-LED anymore. In its place, a Service (ComPair) connector is implemented at the rear of the set, which is directly accessible. In addition to this, there is a blinking LED procedure to show the contents of the error buffer.

The relay you hear during switching 'ON' (via the main switch) is from the degaussing-circuitry. So it is not used for switching the supply as in the MG-chassis.

When using ComPair (connect cable to ComPair-connector at the rear of the set, placed behind a separate cover), there exists the possibility to have a stepwise start-up procedure. With this mode one can startup the set step-by-step. This also means that in certain steps some protections will not be activated. This can sometimes be convenient during repair. See table in 5.4.3, which is describing the stepwise start-up mode with belonging LED behaviour.

On the SSB there are 'service pads' implemented to activate (via bridging) the SDM- or SAM-mode (see chapter 4). When the SDM-mode is activated, the processor-controlled protections (so not the Hardware and HOP-protections) can be overruled. This means that the ADC-input protections (5- and 8 V) and the I^2C not-acknowledging info from Tuner and FBX can be overruled.
WHEN DOING SO THE SERVICE-ENGINEER MUST KNOW WHAT HE IS DOING, AS IT COULD LEAD TO DAMAGING THE SET.

'Repair-tips how to repair the Main power supply:

- Simplest way is to replace components of the Main supply with repair kit (3122 785 90100)
- More detailed way:
  - Replace FET 7504 and zener 6505
  - Remove SSB-panel
  - Short-circuit BE of TS7529 in order to put supply in 'on'-mode (TS7529 is blocking then)
  - Load capacitor C2515 (V_{BAT}) with a load of 500 ohm. Supply can not work without a minimum load.
  - Use a variac to slowly increase the V_{MAINS}. Measure over sensing-resistors R3514/15 whether a nice sawtooth-voltage becomes available. Also measure the V_{BAT}-output
  - V_{BAT} may never exceed 141 V. If so there is something wrong in the feedback-circuitry (e.g. regulator 7506)

Repair-tips how to repair the Standby power supply:

- Simplest way is to replace components of the Standby supply with repair kit (3122 785 90110)

Repair-tips how to repair the Deflection-circuitry:

- Simplest way is to replace components of the Deflection-circuitry with repair kit (3122 785 90120)

Service-tips:

- Be careful measuring on gate of FET 7504. Circuitry is very high ohmic and can easily be damaged.
- Take care not to touch 'hot' heatsink while disconnecting SSB, despite the fact that mains cord is out of mains socket. There still is an annoying rest-voltage for a short while.
- Do not try to measure on side of SSB directed to the hot heatsink. This is dangerous. All service test points are guided to the Tuner side and are pointed out by service printing. Where the circuitry was too crowded to place this service-printing it has been explained on the Test point overviews in this manual

5.7.2 Repair tips

Phenomenon	Possible Cause	Repair-tip
No picture, no LED.	Standby Supply defective.	Measure circuitry (see diagram A2). Start at testpoint P16. Regardless the mode of the set, this voltage should always be available.
No picture, red LED (high intensity) despite expectation the set should be 'on' (this looks like Standby).	There are 2 protections that are not 'seen' by processor, that force set in 'Standby'-mode, namely 'NO-VFB-prot' (= no frame-deflection), or 'BRIDGE_PROT' (safety error).	If protection is activated by 'NO_VFB-prot', this can be measured with a scope on service test point F10 (diagram A4). Before this protection is activated, a few seconds a horizontal white line is visible. The 'BRIDGE_PROT' error may never occur. Is implemented due to legal requirements. Flash protection error (15) will be generated in both cases after 5 restart attempts. Visible via blinking LED procedure. NO_VFB-prot can be determinated by white line.
No picture, red LED blinking (3 Hz).	Set is in protection due to various causes. For error codes see error-code list.	You have no picture, so: - or you read out error buffer via ComPair - or you read out blinking LED information via 'diagnose' x dealer remote - or you read out blinking LED sequence via <default>-button dealer remote - or you read out blinking LED sequence via service default mode entered via RC-command 062596 + 'menu' When error is known, check circuitry related to supply-voltage and I^2C-communication.
No picture, red LED blinking code 6,6,6 or 1,1,1	No communication on I^2C-bus or NVM-I^2C-bus to processor. Set is in protection-mode	As processor cannot communicate with one of the 2 busses it spontaneously starts blinking. Measure dependent of the error on the I^2C-bus which device is loading the bus. This protection can be overruled via SDM-entry on SSB or via stepwise start-up mode step 'MainPowerOn'.
No picture, no sound, set is making audible squeaking sound	Supply could be in hiccup-mode which can be heard via supply-transformer squeaking	This could be caused by: - Short-circuited V_{BAT} (caused by short circuited line transistor 7421) or - Short-circuited sound-winding (amplifier is short-circuiting 28 V) or - Short-circuited D6514 (due to a too high V_{BAT}). Delete excessive load to see where failure is caused by or check feed back circuit. See repair-tip main power supply (supply needs a minimal load).
No picture, no sound, LED works fine	Supply does not work correctly	If e.g. V_{BAT} is only about 90 V, regulator-IC 7506 could be damaged.
No RC5-reception. Red LED does not echo RC-commands.	Processor-circuitry or RC-receiver is wrong.	In case set reacts on local keyboard operation, error must be found in the IR-receiver circuitry (diagram E).
Relay-activation (degaussing) not audible when switch set 'on' from 'off'.	Processor not working correctly.	Check RESET-circuitry on diagram B5. When switching on the set all i/o-pins of processor should become high for a moment, so also the degauss-input signal.
No sound, but picture.	Measure P7 on diagram A1. Possible sound-amplifier is broken (but not short-circuited), or sound-enable line is high (see diagram A5). Further the audio-signal path must be measured (HIP, MSP, switch-IC's, amplifier).	Measure and repair. With ComPair there is a beep-test that can determine where the signal stops (use loudspeakers, headphone).
No sound at headphone output.	Discrete amplifiers or supply to it could be damaged.	Measure A12, A13, A14, A15 and supply-line on diagram A6.
Picture is rotated.	Rotation-circuitry or supply to it could be damaged.	Measure test points F3, R1, R2 on diagram A4.
No picture.	Check functionality and cabling Tuner to SSB.	Notice cable 0946.
Picture looks like cushion, further O.K.	Or NVM-content is overwritten or E/W-MOSFET is short-circuited	First check in Service Alignment Mode, whether geometry can be restored. If not check testpoint L4 and diagram A3, or measure with an ohm-meter whether TS7480 is defective.
Very white picture, with flyback lines visible	180 V is missing on CRT-panel	Probably R3468 on LSP (diagram A3) is interrupted, or bad connection plug 0324 to 0224 (CRT-panel).
Un-sharp picture	Focus could be mis-aligned or SCAVEM-circuitry does not work correctly	Align focus-potmeter of Line Transformer; check SCAVEM-circuitry on CRT-panel [F].
Un-synced picture	Sync is derived in HIP-IC from X-tals 1305 and/or 1308	Maybe a X-tal is making bad contact.
Picture distorted.	Check video-path, service default mode.	Investigate whether there exist an error code in the error buffer. In case there is an error code, check I^2C-bus and/or supply-lines (see overview supply-lines). Measure and check signal path Tuner, HIP, PICNIC, HOP, RGB-amplifier. In case it is a geometry-issue, check Frame-circuitry, alignments or possible corrupted NVM (7011)
No menu, OSD.	Probably processor is defective.	Measure test points C7, C8, C9, C10 on diagram B5. cl96532156-037.eps 090200

Personal notes:

Personal notes:

Personal notes:

Personal notes:

8. Electrical alignments

8.1 General alignment conditions

All electrical alignments should be made under the following conditions:

- Power supply voltage: 230 V ± 10 %; 50 - 60 Hz ± 5 %. Should be applied via an isolating transformer with low internal resistance.
- Warm-up time ≈ 20 minutes.
- Voltages and oscillograms are measured in relation to Tuner earth (with exception to the voltages on the primary side of the power supply). Never use the cooling fins/plates as ground: they are 'hot' ! ! !
- Test probe: Ri > 10 MΩ, Ci < 20 pF.
- Use an isolated trimmer/screwdriver for the alignments

8.2 Alignments on the large signal panel (LSP)

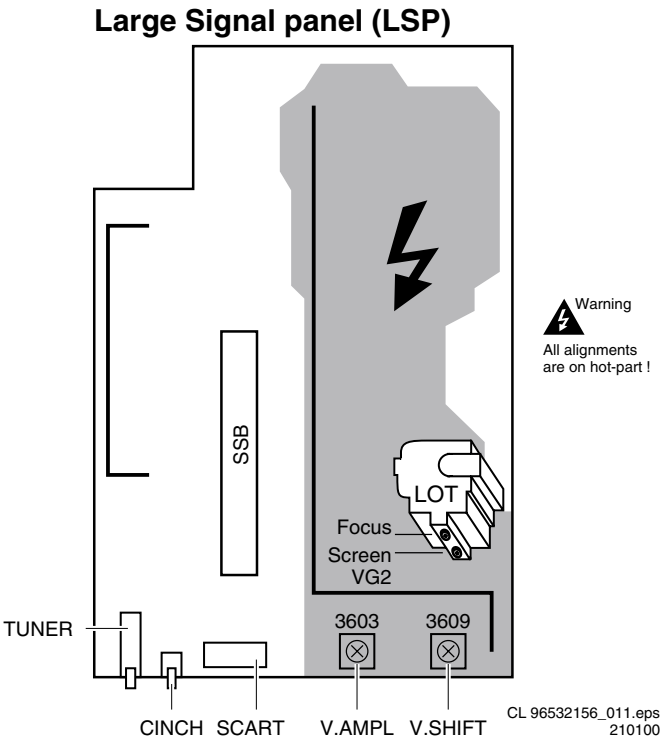

Figure 8-1

8.2.1 Focusing

1. Tune the set to a crosshatch test pattern (use an external video pattern generator).
2. Adjust the Focus potentiometer (upper potmeter, see figure 8-1) for an overall optimum focusing of the picture.

8.2.2 Vg2 adjustment

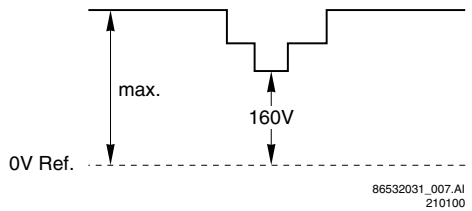

Figure 8-2

Elucidation: In the frame blanking period of the R, G and B signals applied to the CRT, a measuring pulse with different DC levels is inserted by the 'HOP' video processor. Measure the black level pulse during the vertical flyback at the RGB cathodes of the CRT.

1. Put the set in the SDM mode (see chapter 5.2.1).
2. Insert a black test-pattern signal (carrier 475.25 MHz) to the Tuner input.
3. Connect an oscilloscope (position 50 V/Div DC and 2 ms/Div) alternately to the CRT cathodes (Red pin 8, Green pin 6, Blue pin 11) and measure for each cathode the DC level of the measuring pulse (see elucidation above and figure 8-2) and write down each value. Remark: Trigger the scope external via a CVBS signal (for instance via pin 19 of the SCART1 connection).
4. Adjust the Vg2 potentiometer (lower potmeter, see figure 8-1) so that the measuring pulse with the highest noted level is on 160 ± 3 V_{DC} level.

8.3 Vertical amplitude alignment

1. Tune the set to a crosshatch test pattern (use an external video pattern generator).
2. Align the vertical amplitude with R3603 (see Fig. 8-1) so that the complete test pattern is visible.

8.4 Vertical shift alignment

1. Tune the set to a crosshatch test pattern (use an external video pattern generator).
2. Align the vertical centering with R3609 (see Fig. 8-1) so that the test pattern is located vertically in the middle.
3. Repeat the 'vertical amplitude' alignment if necessary.

8.5 Alignments and settings in the Service Alignment Menu

8.5.1 General

Put the set in the SAM mode (see chapter 5.2.2). The Service Alignment Mode menu will now appear on the screen. Via 'Alignments' the following submenu's can be selected:

- General:
  - Drive
  - Luminance Delays
  - EHT Compensation
  - Soft clipper
  - Luma gain
  - IF AFC
  - Tuner AGC
  - Blend intensity
  - Adjust Peak White Limiter
  - Vg2 Test Pattern
- Normal Geometry: General geometry alignments.
- Super Wide Geometry: Geometry alignments for the 'Panorama' position in 16:9 sets (only valid for wide screen sets; alignments can be performed, however, it is better to set values as mentioned below).
- Options: Setting the initialisation codes in the set via text.
- Option Numbers: All options together, expressed in two long numbers. The original factory setting for these numbers can be found on the picture tube sticker on the inside of the set.
- Store: Store all alignments.

The alignments are explained now in the sequence of the sub-menu:

8.5.2 'General' alignments in Service Alignment Menu:

- Once all alignments/settings have been completed the item 'Store' must be selected to record all the values in the permanent memory of the set.
- If the Option codes have been changed and stored, the set has to be switched 'OFF' and 'ON' using the mains switch to activate the new settings (when switching via Standby, the option code settings are NOT read by the microprocessor).
- If an empty EAROM (permanent memory) is detected, all settings are set to pre-programmed default values.
- A built-in test pattern can be called up in various sub-menus. The test pattern generator can be switched on using the item 'Test pattern on/off'. The test pattern only appears AFTER the specific alignment has been selected. The test patterns are generated by the Teletext-IC (OTC).

'Drive'

- Method 1 (with colour analyser):
  1. If you want to align tint-settings with a colour-analyser, the Test pattern must be switched on. You get a white block in middle of the image now.
  2. Before doing the Tint-settings the 'Cathode'-parameter must be aligned. This is dependent of the picture tube size and brand. See table “Cathode parameter” for the colour-analyser readings.
  3. Tint-settings: Set the white levels for the 3 Tint-settings 'Normal', 'Warm' and 'Cool'. The next values must be aligned (see table “White levels”).

Cathode parameter	
CRT	Light output (cd/m^2)
25" FS	500
28" FS	350
29" SF	400
28" WS	450
32" WS	400

White levels			
	Cool	Normal	Warm
X	280	289	303
Y	287	299	314
Temp. (K)	10200	8700	7200

- Method 2 (without colour analyser):
  1. Without having a colour-analyser one can set some parameters. This is the next best solution. The setting-parameters are average values coming from production (statistics).
  2. Before doing the Tint-settings the 'Cathode'-parameter must be set. For all picture tubes the value '5' must be entered.
  3. The ‘Tint’ setting must be on ‘normal’.
  4. Tint-settings: Set the Red, Green and Blue parameters for the 3 Tint-settings 'Normal', 'Warm' and 'Cool'. See table 8.4 for the values.
  5. Red BL offset: herewith the Black Level can be aligned very precise. Pre-set value is 7.
  6. Green BL offset: herewith the Black Level can be aligned very precise. Pre-set value is 7.

Tint settings			
	Cool	Normal	Warm
R	(-1)	25	(+2)
G	20	20	20
B	(+4)	14	(-4)

‘Luminance delays’

With the 'Luminance delays' alignment the luminance information is placed on the chrominance information (brightness is pushed onto the colour). Use a colour bar/grey scale pattern as test signal.

- Lum. Delay Pal: Apply a PAL colour bar/grey scale pattern as a test signal. Adjust ‘Lum. Delay Pal’ until the transients of the colour part and black and white part of the test pattern are at the same position.
- Lum. Delay Secam: Apply a SECAM colour bar/grey scale pattern as a test signal. Adjust ‘Lum. Delay Pal’ until the transients of the colour part and black and white part of the test pattern are at the same position.
- Lum. Delay Bypass: apply a NTSC colour bar/greyscale pattern as a test signal. Adjust value until the transients of the colour and black & white part of the test area are at the same position.

‘EHT compensation’

Fixed setting: 0

‘Soft clipper”

Fixed setting:Pwl + 0%

‘Luma gain’

Fixed setting:1

‘IF AFC’

The SAM-mode is needed to make alignment, a test generator to make signal and the Installation-menu to check the 'Fine Tune' value.
Supply, via a video generator (e.g. PM5518), a TV-signal with a signal-strength of at least 1 mV and a frequency of 475.25 MHz. Use BG if possible, otherwise match the system of your generator with the received signal in the set.

Alignment procedure:

1. Go to the 'Installation' menu.
2. Select 'Manual installation'.
3. Tune the TV-set to the system and frequency described above via 'Search' - '475' - 'OK'.
4. If the frequency showed in the line 'Fine tune' is between 475.18 MHz and 475.31 MHz, you don't need to re-adjust the IF-AFC.
5. If not, adjust the frequency in the 'Fine tune' line to 475.25 MHz and 'Store' the program (this is very important because this will disable the AFC algorythm).
6. Now go to the SAM and select 'Alignments' - 'General' - 'IF AFC'.
7. During the 'IF AFC'-parameter adjustment, one can see OSD feedback in the top of the screen. The OSD feedback can give 4 kind of messages:

AFC-window	AFC-frequency versus reference
Out	High
In	High
In	Low
Out	Low

The first item (In or Out) informs you whether you are in or out the AFC-window.
The second item (High or Low) informs you about whether the AFC-frequency is too high or too low.

1. First you must align the 'IF AFC'-parameter such that you come into the AFC-window (= 'In')
2. Then you must look for the point where the 'IF AFC'-parameter changes from High to Low. This level is the value you are looking for.
3. After adjustment 'Store' the value.
4. Now return to the 'Installation' menu.
5. Select 'Manual Installation' - 'Search' - '475' - 'OK' and 'Store'. This will set the AFC 'on' again.

Service-tip: If you do not trust the accuracy of the frequency of your Service-generator, first 'measure' with 'Fine tune'-line (manual install-menu) of a good set your video generator.

'Tuner AGC'
The SAM-mode is needed to make alignment, a test generator to make signal, a DC-Voltmeter to measure at pin 1 of Tuner.

Supply a TV-signal, with a frequency of 475.25 MHz and a signal-strength of about 2 mV. Measure the DC-voltage on pin 1 of the Tuner (position 1200). With the 'Tuner AGC'-alignment in the SAM-menu, this voltage can be aligned. Alignment is correct when DC-voltage is just below 3.5 V.

'Blend intensity'
(This alignment could be used when micro controller or HOP-IC has been replaced).
It aligns the level of transparency of the menu-picture blended into the main-picture.
1. Position the brightness-, contrast- and colour setting in the middle position (picture-menu).
2. Apply a signal with a 100 % white video-pattern.
3. Connect an oscilloscope to pin 7 of connector 0340 of the CRT panel and measure the Red output level.
4. Align 'blending intensity'-parameter such that the blended signal is 65 % of the black-white amplitude. Practically this will be about 1.3 V (blended signal) versus 2 V (full white signal).
5. The parameter can be adjusted in between 0 and 31.

'Adjust Peak White Limiter'
Depending on the picture-tube size, the next value of the table must be entered:

Peak White Limiter	
25" FS	4
28" FS	4
29" SF	4
24" WS	4
28" WS	4
32" WS	4

'Vg2 Test Pattern'
Here the Vg2 Test pattern can be switched on.

8.5.3 'Normal Geometry' alignments in the Service Alignment Menu

Warning: At this moment, the 'INTERNAL TEST PATTERN' of the set software will lead to a mis-alignment of the picture geometry. Therefor use an external generator with a geometry pattern (e.g. crosshatch) to align the set (only for the 'Vertical slope' adjustment the internal test pattern can be used).

'Vertical slope'
Select 'Test Pattern on' (read warning above).
1. Set the start conditions for 16:9 sets: 'V. S-correction' value on 8 for the 28" and on 7 for the 32" set. The boundary-stripes of the test pattern should be positioned on the edge of the picture tube.
2. Align 'V. slope' (when aligning the below half of the picture is blanked). The middle line of the test pattern must be matched with the edge of this blanking/picture transient in the middle of the picture. Pushing 'MENU' button again, gives you previous menu again. (This alignment is meant to align the zero crossing of the frame-deflection to the mechanical middle of the picture tube.)

'Horizontal amplitude and centring'
Use an external pattern generator with a geometry pattern (e.g. crosshatch).
1. Using 'H. amplitude' align the horizontal amplitude so that the entire test pattern is visible.
2. Use an external test signal, with a centre-reference from a service-generator. Use 'H shift' to align the picture horizontally in the middle.
3. Repeat the 'H amplitude' alignment if necessary.

'East/west alignment'
Use an external pattern generator with a geometry pattern (e.g. crosshatch).

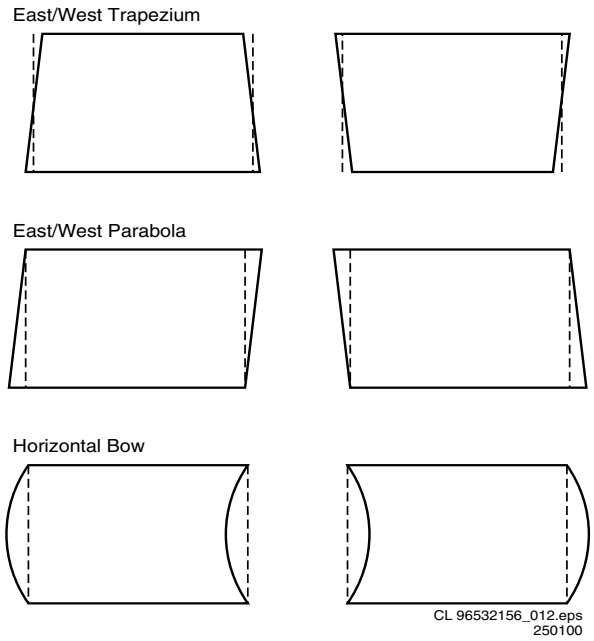

Figure 8-3

1. Use 'East/West Parabola' to align the vertical lines until straight.
2. 'Upper East/West corner' to align the vertical lines in the upper corners until straight.
3. 'Lower East/West corner' to align the vertical lines in the lower corners until straight.
4. Use 'East/West Trapezium' to align for a rectangular.
5. Use 'Horizontal Parallelogram' to align for straight vertical lines if necessary.
6. Horizontal Bow' (neutral value 31. With this alignment the E/W parabola can be corrected such that it becomes symmetrical).

Repeat steps 1 to 6 if necessary.

8.5.4 'Super wide geometry' alignments (for widescreen sets) in the Service Alignment Menu

The header of this paragraph and also the menu's are somewhat misleading. We only need to set the following values (if the normal geometry alignment has been performed correctly):
1. V. S-Correction: enter value of 'normal geometry' alignment.
2. H. amplitude: enter value of 'normal geometry' alignment subtracted by 4.
3. East/west Parabola: enter value of 'normal geometry' alignment.

8.6 Option menu

8.6.1 Introduction:

The microprocessor communicates with a large number of I^2C-IC's in the set. To ensure good communication and make digital diagnosis possible, the microprocessor has to know which IC's have to be addressed. The presence of specific IC's or functions is made known by means of the option codes.

All options codes can be manipulated using both the option numbers and/or the Option menu.
All hardware related options are incorporated under the heading 'Options' of the 'Alignments' sub-menu of the 'Service Alignment Mode'. All software related options that are incorporated under the heading 'Dealer Options' of the 'Service Alignment Mode'', can also be reached directly via the 'DEALER' button of the DST.

8.6.2 Options in the Service Alignment Mode

Menu-item	Subjects	Options	Physically in the set
Dual screen/PIP	Aux type	Yes	Dual Screen / PIP module present
		No	Dual Screen / PIP module not present
Teletext/EPG	TXT	Yes	Teletext present
		No	Teletext not present
	NextView present	Yes	NextView set
		No	NextView not set
	NextView type	Flashram	Flash-RAM present
		No Flashram	Flash-RAM present
Communication	Easylink Plus	Yes	Easylink Plus set
		No	Easylink Plus not set
Picture Tube	CRT Type	4:3	4:3 picture tube
		16:9	16:9 picture tube
	Picture Rotation	Yes	Frame rotation circuitry present (diagram A4)
		No	Frame rotation circuitry not present
	Dynamic focus	Yes	Dynamic focus picture tube present
		No	Dynamic focus picture tube not present
	Dooming prevent	Off	
		4:3	
		SF 16:9	
		RF 16:9	
Video repro	Featurebox type	Eco	PROZONIC not present
		Prozonic	PROZONIC present
	Field memories	2	
		3	
	Lightsensor	Yes	Lightsensor present
		No	Lightsensor not present
	PALplus	Yes	PALplus module present
		No	PALplus module not present
	Combfilter	Yes	Not valid for Europe
		No	
	Picture improvement	Yes	
		No	
	Picnic	Yes	PICNIC present
		No	PICNIC not present
	Picnic AGC	Yes	In normal operation: Yes
		No	During 'Drive' alignments: No
	Signalling bits	Yes	
		No	
Source Selection	External 3	Yes	3rd EURO connector present
		No	No 3rd EURO connector present
	External 4	Yes	4th EURO connector present
		No	No 4th EURO connector present
Audio Repro	Dolby	None	
		Pro Logic	
	Rear speakers	Corded	Passive surroundbox present
		Virtual	
		Cordless	Active surroundbox present
	Acoustic system	FL7	Applicable for sets with subwoofer
		FL8	Applicable for sets without subwoofer
		FL9 Monitor	Monitor look (only tweeters at both sides)
		FL9 DAS	FL9 with full range speakers at both sides
	MSP type	MSP3411	
		MSP3415	
		MSP3451	
	AVL enable	On	
		Off	
Miscellaneous	Heatsink Present	Yes	Heatsink present on CRT/SCAVEM panel (diagram F)
		No	Heatsink not present on CRT/SCAVEM panel (diagram F)
	Tuner type	UV1316	
		TEDE9	

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8.6.3 Dealer Options in the Service Alignment Mode

- After the option(s) have been changed, they must be stored via the 'STORE' command.
- The new option is only active after the TV is switched off and then back on again using the mains switch (the EAROM is then read out again).

8.6.4 Option number

In case the EAROM has to be replaced, all the options will also require resetting. To be certain that the factory settings are reproduced exactly, both option numbers have to be set. These numbers can be found on a sticker on the picture tube.

Example: Option number 34PW9815 could be:
04929 04418 04417 00016
08199 00001 00000 00000

The first line indicates the hardware options 1 to 4, second line is reserved for the software options.
Every 5-digit number represents 16 bits (so maximum number can be 65536 if all options are set).

Bit	HW1	HW2	HW3	HW4	SW1	SW2	SW3	SW4
0 (1)	FBX (1)		EXT3	MSP (8)	Auto TV	CTI		
1 (2)	FBX (1)	Dolby PL	EXT4	MSP (8)	Auto Store mode (10)			
2 (4)	FBX (1)	Virtual rear spkrs		China IF	Auto Store mode (10)			
3 (8)	Combfilter	Cordless rear spkrs		Tuner (9)				
4 (16)	PAL-Plus	Dolby Digital	Dual Screen (6)	TXT	Picture mute			SLDP (13)
5 (32)	Field mem. (2)		Dual Screen (6)	China TXT	Demo			SLDP (13)
6 (64)	Light sensor	Cabinet (4)	TXT-EPG-DS		Virgin			AVL
7 (128)	LTP	Cabinet (4)	Aux-headphone					
8 (256)	PICNIC	P50	Aspect Ratio (7)					
9 (512)	PICNIC-AGC		Tilt					
10 (1024)			DAF					
11 (2048)	LNA (3)							
12 (4096)	WSS	EPG	Heatsink		TXT pref. (11)			
13 (8192)	Time constant	EPG type (5)	Home Cinema		TXT region (12)			
14 (16384)								
15 (32768)								

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All bits can be set 'On' (= 1) when the option is available or 'Off' (= 0) when it is not, except for:
(1) 0 = Eco, 1 = PROZONIC, 4 = Eco-DNR.
(2) 0 = 2 Field memories, 32 = 3 Field memories.
(3) 0 = Normal, 8192 = Fast.
(4) 0 = FL7, 64 = FL8, 128 = FL9.
(5) 0 = Type 2, 8192 = Type 2C3.
(6) 0 = None, 16 = PIP, 32 = Dual Screen.
(7) 0 = 4:3, 256 = 16:9.
(8) 0 = MSP3415, 1 = MSP3451, 2 = MSP3411.
(9) 0 = Philips, 8 = Alps.
(10) 0 = None, 2 = PDC/VPS, 4 = TXT-Page, 6 = PDC/VPS/TXT-Page.
(11) 0 = TOP, 4096 = FLOF.
(12) 0 = East, 8192 = West.
(13) 0 = Off, 16 = 4:3, 32 = SF16:9, 48 = RF16:9.
When all the correct options are set, the sum of the decimal value (between brackets in 1st column) of each column will give the option number.

9. Circuit descriptions and abbreviation list

9.1 Circuit descriptions

The following circuits are described:
1. Introduction
2. Block diagrams
3. Power supply
4. Control
5. Tuner & IF
6. Video: High-end Input Processor
7. Video: Feature box
8. Video: High-end Output Processor
9. Synchronisation
10. Horizontal deflection
11. Vertical deflection
12. Audio
13. Teletext / NexTView
14. CRT / SCAVEM / Rotation
15. Software related features

9.1.1 Introduction

The EM2E Europe is a lower specified MG-chassis. EM stands for Eco-MG, 2 for the used processor (1 = Painter, 2 = OTC) and E stands for Europe. This will be, at the moment of launch, the cheapest realised 100 Hz set.

The architecture consist of a conventional large signal panel (LSP) and a small signal board (SSB) module, placed into a so called SIMM-connector (Standard Interface, 80 pins).

The LSP is built up very conventional, with hardly any surface mounted components on the copper side. Difference with the MG-chassis is that the EM2E LSP has a very large 'hot' part, including the deflection coil.

The SSB is a high tech module (2 sides reflow technology, full SMC) with very high component density and complete shielding for EMC-reasons. Despite this, it is designed in such a way, that repair on component level will be possible. To achieve this, attention has been paid to:
- The position of service test lands (Tuner side).
- Accessibility (Tuner side).
- Clearance around surface mounted IC's (for replacing).
- Diagnostics & Fault Finding via ComPair.

Due to the low amount of cabling etc., expectation is that the FCR will be low.

Attention: During the first 4 to 6 months of production, the EM2E set-software will be integrated into a flash-RAM on the SSB. After that period, a mask-ROM will be used. Which IC is used is not of interest for service, but for both solutions it means that Service Workshops must be equipped with dedicated (de)solder equipment for exchanging these IC's.
In case flash-RAM or mask-ROM has to be replaced in the field, dealer will receive always an up-to-date flash-RAM.

Warning: Be aware that half of the LSP-circuitry is 'hot', including the deflection coil.

Protection: The start-up behaviour of the EM2E is different then that of the MG-chassis, meaning that there does not exist a situation as in the MG where we have 'supply ON / deflection circuit OFF'.
This means that isolating failures in the EM2E must be done in a different way. See Chapter 5 of this manual.

9.1.2 Block diagrams

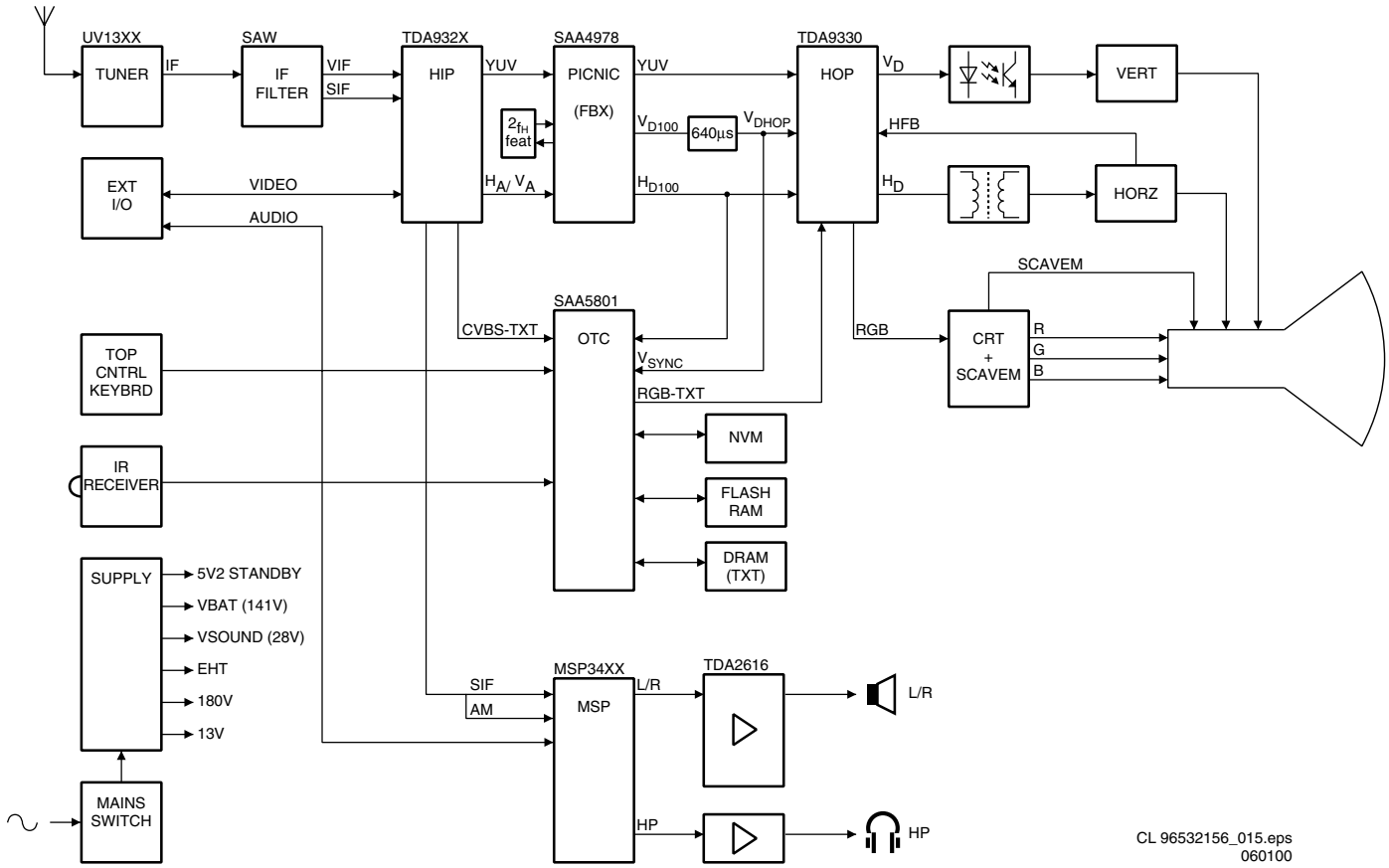

Figure 9-1

The tuner type UV1316 is a PLL tuner and delivers the IF-signal, via audio & video SAW-filters, to the HIP (High-end Input Processor). The HIP has the following functions:

- IF modulation.
- Video source- and record select.
- Colour decoder.
- Synchronisation.

Two SCART-connectors can be used: SCART1 is fully equipped and SCART2 is meant for VCR. Pin 10 of SCART2 is used for Easylink and there is a possibility for Y/C in. The CVBS-out on pin 19 can be used for WYSIWYR (What You See Is What You Record).

The HIP delivers the signal to the PICNIC. This IC takes care of:

- Analogue to Digital conversion and vice versa.
- 50 to 100 Hz conversion.
- Panorama mode.
- Noise reduction.
- Dynamic contrast.

For Digital Scan the PROZONIC is required, which can be connected to the PICNIC. This IC is mentioned as 2fH features in the blockdiagram.

After the PICNIC the, now 100 Hz, YUV- and H/V-signals are fed to the HOP (High-end Output Processor). This IC handles the video control and geometry part. The RGB-signals from TXT/OSD are also inserted via the HOP. The video part delivers the RGB signals to the CRT-panel and the geometry part delivers the H-drive, V-drive and also a drive-signal for rotation (as a variable DC-level on the V-drive signal).

Both deflection circuits are 'hot' and located on the LSP and are driven by the HOP. To make the galvanic separation, the line drive is driven via transformer 5410 and the framedrive via optocoupler 7610.The horizontal output stage generates some supply voltages, the EHT-, focus- and Vg2-voltages.

The RGB amplifiers on the CRT-panel are integrated in one IC and are supplied with 180 V from the LOT.
The SCAVEM circuit modulates transitions of the Luminance (Y) signal on the horizontal deflection current, giving a sharper picture.

The sound part is built around the MSP34xx (Multichannel Sound Processor) for IF sound detection, sound control and source selection. Dolby decoding is also done by the MSP. Amplification is done via an integrated power amplifier IC, the TDA2616.

The microprocessor, called OTC (OSD, Teletext and Control), takes care of the analogue TXT input- and output processing. The OTC, ROM and RAM are supplied with 3.3 V, which is derived from the +5VSTANDBY.
The NVM (Non Volatile Memory) is used to store the settings, the FLASH RAM contains the set software and the DRAM is used for storing the Teletext pages.

In EM2E there is a separate Standby Supply in order to reduce the Standby power consumption. During Standby, the Main Supply is switched off (via TS7529). A relay is used to switch the Degaussing circuit.

The Main Supply, a SMPS based on the 'down-converter' principle, generates the 141 V (V_{BAT}) and the 28 V for the audio part.
Difference with former MG-sets is that V_{BAT} is not mains isolated (is 'hot') and is alignment free.

9.1.3 Power supply (diagram A1 & A2)

General

The power supply has a number of main functions. These functions are dealt with in succession:

- Mains filter
- Degaussing picture tube
- Standby power supply
- Main supply

Mains filter (diagram A1)

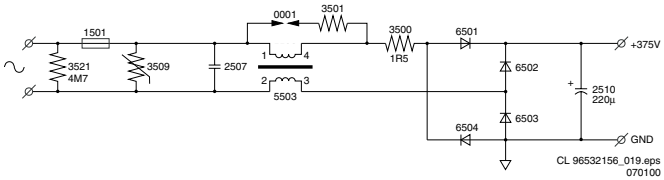

Figure 9-2

The mains filter has 2 functions: it prevents high-frequency signals to be transferred into the mains and it protects the set from lightning damage.

C2507 prevents the high-frequency signals, generated by the set, to be conveyed into the mains by short-circuiting them.

In case of a lightning surge between the 2 phases (differential mode) the energy is immediately bled away through the VDR (R3509) to the other phase.
In case of a lightning surge on both phases of the mains in relation to the aerial earth, the mains filter acts as a high resistance (U_{EMK}=L * dI/dt) as a result of which the voltage across coil L5503/04 increases. A spark gap (0001) prevents that the voltage increases too much, which would lead to a damaged coil. When ignited, the current will be discharged via this spark gap.
The two networks using R3503//0002 and R3502//0003 are also used for lightning protection. They lead the energy of a common-mode lightning surge from the 'cold' to the 'hot' side in case of insertion on the aerial or from the 'hot' to the 'cold' side in case of insertion via the mains-input.
Resistor R3500 is used for limiting the inrush-current.

For 240 V_{AC} mains-voltage applications, jumper 9502 is used. Diodes 6501 to 6504 now work as bridge rectifier charging C2510. For 110 V_{AC} mains-voltage applications, i.s.o. jumper 9502, jumpers 9503 and 9504 are used. Now the diodes will work as a voltage doubler charging C2516 and C2517 (not implemented for Europe).

Degaussing picture tube (diagram A1)

After switching 'ON' the set via the mains-switch, the DEGAUSS_INPUT signal from the processor (OTC) will be made high, transistor 7528 will conduct and relay 1002 will be activated. Initially a considerable current will flow, via PTC 3516, through the degaussing coil. The PTC will heat up, resistance will rise and the current will decay rapidly. The OTC will switch off the relay after 12 seconds.

Standby power supply (diagram A2)

This power supply is of a SOPS type (Self-Oscillating Power Supply) and is regulated by the controlled switching of an oscillator. It uses the so-called 'Flyback' principle:

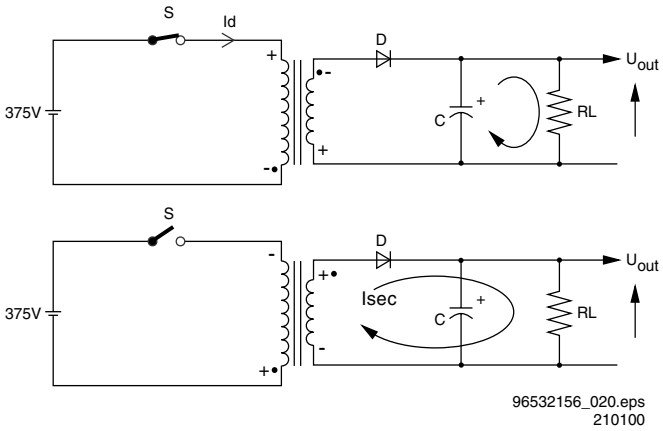

Figure 9-3

- After closing switch 'S', the current I_D will increase linear in time. The magnetic energy in the primary coil is directly proportional with the self-inductance of the coil and current I_D (thus with the time the switch is closed). The voltage polarity at the secondary winding is negative (due to different winding direction), meaning that diode D will block. Capacitor C will discharge via R_L, U_{OUT} will decrease.
- Opening switch 'S' will generate a counter-e.m.f. in the primary winding, trying to maintain current I_D. Through this the polarity of the secondary voltage will inverse. The magnetic energy, stored in the coil, will now be transformed to the secondary side. Diode D will now conduct, capacitor C will be charged and U_{OUT} will increase.

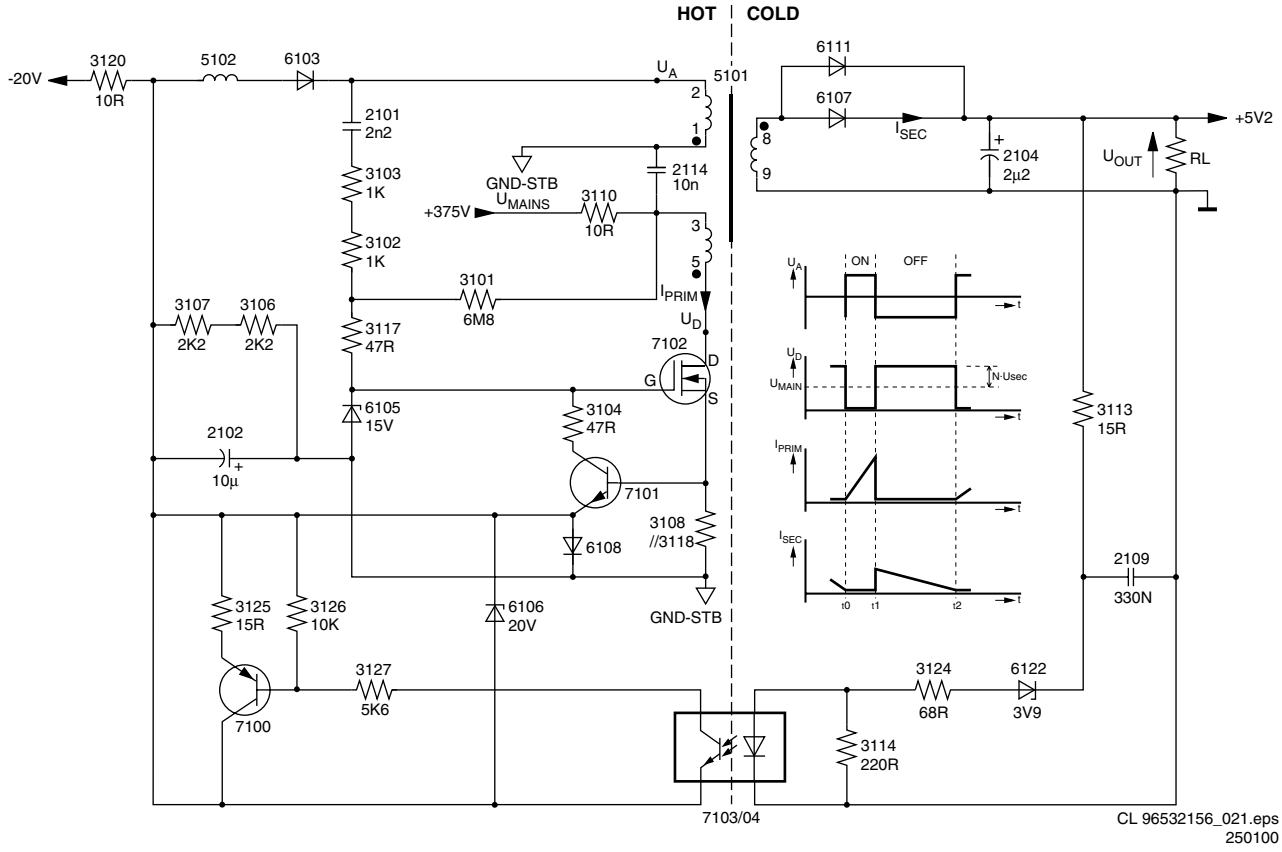

Figure 9-4

To apply this on the EM2E (diagram A2): replace Switch 'S' by FET TS7102, coil L by L5101, diode D by D6107//D6111 and C by C2104.

Time interval t0 - t1:
After switching on the set, the gate of MOSFET TS7102 will be high (max. 15 V due to zenerdiode D6105). This will drive the FET into saturation (U_{DS} = 0 V). The DC-voltage U_{MAINS} will be transposed across the primary winding of L5101 (3, 5) resulting in a linear increasing current through this coil.
The voltage across the co-coupled coil (1, 2) is also positive and will keep the FET into conductivity via C2101, R3103, R3102 and R3117 for some time. The slope of the primary current is determined by the self-induction of the coil and on the magnitude of the supply voltage (+375 V).
The maximum current is determined by the time the FET stays into conductance (t0 - t1). This time is directly determined by the voltage across R3108//R3118. This voltage is a measure of the current and if it exceeds 1.4 V, TS7101 will be driven into conductivity and consequently connect the gate of TS7102 to earth; the FET will block. The current will be: 1.4 V / (15//4.7 ohm) = 0.39 A.
The voltage across the secondary winding (8,9) will be negative, diodes D6111 and D6107 will block.

Time interval t1 - t2:
The sudden current interruption in the primary coil, will induce a counter-e.m.f. that wants to maintain the current. The voltage on the drain of the FET will increase. The secondary voltage (8, 9) will become positive and will charge C2104 via D6107 and D6111. All energy that was stored in L5101 during t0 - t1 will be transferred into the load. Due to the transformer principle, a voltage will now be induced in the primary winding (3, 5) and the co-coupled winding (1, 2). This voltage will be: N * U_{SEC} (N = winding ratio).
The voltage across the co-coupled coil will be negative, keeping the FET blocked.

Time t2:
At t2, the current through the secondary coil will be reduced to zero, as C2104 is no longer charged. As a consequence, the voltages will decay and will change polarity. The gate of the FET will be again made positive, is driven into conductivity and the cycle starts again.

Feedback, stabilisation:
The Standby Power Supply always oscillates at maximum power, the only limiting factor is the maximum primary current which has been pre-set with R3108//3118.
U_{OUT} is determined by R3114, R3124 and zenerdiode D6122. If the voltage across R3114 exceeds the threshold voltage of the diode of the optocoupler 7104 (±1 V) or, in other words, U_{OUT} exceeds 5.2 V, the transistor of the optocoupler will conduct.
Transistor TS7100 will be driven and a negative voltage will be transposed to the emitter of TS7101. When TS7101 conducts, the gate of the FET is at earth potential forcing the oscillator stop. Due to the load, the secondary voltage U_{OUT} will decrease. At a certain voltage, optocoupler TS7103/04 will block and the oscillator will start again.
Since there are no capacitors and there is a high amplification-factor in the feedback circuit, the feedback is ultra-fast. This is why the ripple on U_{OUT} is minimal. The negative supply voltage (-20 V) used in the feedback circuit originates from the co-coupling coil and is rectified through D6103.
Stabilisation is not effected through duty-cycle control but through burst-mode of TS7100.
Burst-mode is load dependent. If the power supply is less loaded, the secondary voltage will have the tendency to increase more rapidly. If the load on the power supply

increases, then the oscillator stops less often, right up to the moment that the oscillator is operating continuously: maximum load. If the power supply is now loaded even more, the output voltage will decay. The maximum load is determined by the maximum primary current set by R3108//3118.

Protection:
If the optocoupler would fail, the secondary voltage will increase. This would have disastrous consequences since many IC's (e.g. OTC, flash-RAM, DRAM) are fed with this 5.2 V. In other words, very expensive repairs would be required. We already know that the negative supply is directly dependent upon the secondary 5.2 V, as a consequence of which the negative supply will increase proportionally as the secondary voltage increases.
If the negative supply in the mean time reaches -30 V, D6106 will start to zener and as a consequence TS7101 will start conducting. Basically, D6106 will take over the stabilisation task of the optocoupler, however, with a considerable spread: from -20 V to -30 V is a 50 % increase, thus U_{OUT} will increase from 5.2 V to max. 7.5 V.

Main supply (diagram A1)

Some important notes on beforehand:
- V_{BAT} is not isolated from the mains supply ('hot').
- V_{BAT} is alignment free.

The Main Power Supply, generates the 141 V (V_{BAT}) and the 28 V for the audio part and is based on the so-called 'down converter' principle.

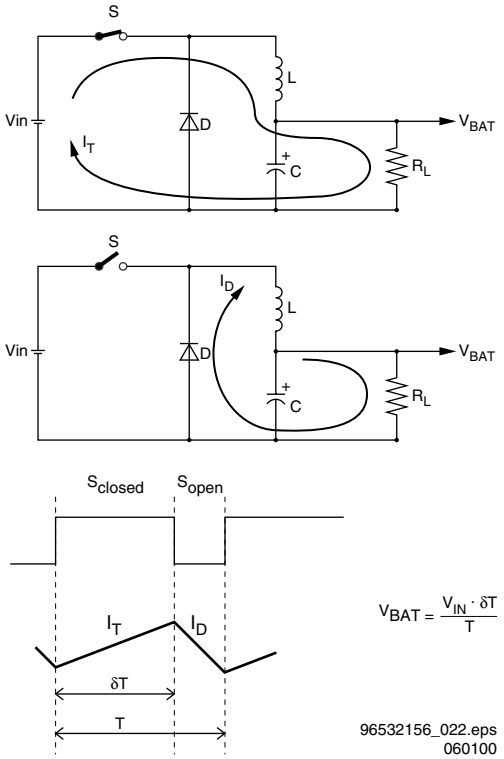

Figure 9-5

- After closing switch 'S', the linear in time increasing current I_T, , will charge capacitor C.
- Opening switch 'S' will generate a counter-e.m.f. in coil L, trying to maintain current I_T. This is possible via diode D (this diode is also called 'freewheel diode'). So after opening 'S', the magnetic energy stored in coil L will be transferred to electrostatic energy in capacitor C. The V_{IN} will only supply current during the time that 'S' is closed while a constant current is flowing through R_L.
- V_{BAT} is directly proportional with V_{IN} and the time that 'S' is closed and reverse proportional with period time 'T'. So by changing the duty cycle, it will be possible to control V_{BAT}.

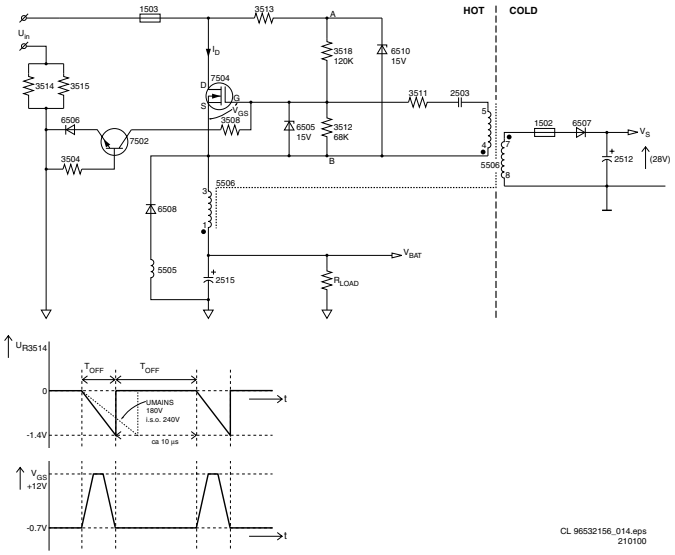

Figure 9-6

At start-up of the main supply, C2515 can be assumed as being a shortcircuit. U_{AB} will be 15 V (R3513, D6510) and U_{GS} of the FET will be +5.4 V (voltage division over R3512 and R3518). The FET will be driven into saturation (same as closing switch 'S'). The drain-current will increase linear in time. With other words: resistors R3513 and R3518 will start the oscillator. The voltage across the co-coupled coil (4, 5) is also positive and will keep the FET into conductivity.

The drain-current will also flow through R3514//R3515. The voltage on the base of TS7502 will be +0.8 V due to the stabilisation circuit (which is explained further). At increasing current, the emitter-voltage of TS7502 will get more negative. When this voltage reaches -0.7 V, TS7502 will be driven into conductivity and consequently connect the gate of TS7504 to earth; the FET will block (same as opening switch 'S'). The maximum drain-current is: 0.7 V / (R3514//R3515) = 1.4 A. The voltage polarities on L5506 will invert, keeping the gate of TS7504 negative via the co-coupled coil (4, 5). The voltage on the secondary winding of L5506 (7, 8) will be positive, generating the +28 V audio supply voltage via D6507 and C2512.

The sudden current interruption in the primary coil, will induce a counter-e.m.f. that wants to maintain the current via the 'freewheel' diode D6508. This current is linear decreasing in time and as it is also flowing through R3414//R3415, TS7502 will be blocked after a certain time period. The gate of the FET will be again made positive, is driven into conductivity and the cycle starts again.

Stabilisation of V_{BAT}:
The output voltage V_{BAT} will be determined by: $V_{BAT} = V_{IN} * T_{ON} / (T_{ON} + T_{OFF}) = V_{IN}$ * duty-cycle.
To stabilise the output voltage, a feedback loop is implemented, which will reduce T_{ON} when V_{BAT} increases and vice versa.

Via a voltage divider, excisting of (1 %) resistors R3507, R3510 and R3527, a voltage of 2.5 V (when V_{BAT} = 141 V) is fed to the input of precision shunt regulator 7506. This regulator will

conduct, a current will flow through R3524 and TS7505 will be driven into conductivity. The base of TS7502 will now be set at a certain positive voltage. As this transistor switches the FET TS7504 on and off, this circuit can determine the dutycycle.

E.g. when the load increases, V_{BAT} will decrease. As a consequence, the input-voltage of regulator 7506 will decrease, resulting in a lower current. Through that the emitter-base voltage of TS7505 will diminish.
The current through R3504 will decline, changing the base-voltage of TS7502 and through that the T_{ON} (will increase) of the FET. The output voltage V_{BAT} will rise.
If the load continues to increase, the regulator will block at a certain moment, the collector-current of TS7505 will now be zero. If there flows no current through R3504, T_{ON} will now be maximum (I_{MAX} = 1.4 A). This is the point where V_{BAT} will be below 141 V, and at further increasing load will be switched off (The voltage across the co-coupled coil (4, 5) will decrease due to the increasing load. Therefore the voltage on the gate of TS7504 comes below the threshold voltage. The supply switches off and an audible hiccuping can be heard).

On the other hand when the load decreases, V_{BAT} will rise. As a consequence, the input-voltage of 7506 will also rise resulting in a higher current. The current through R3504 will rise, changing the base-voltage of TS7502 and through that the T_{ON} (will decrease) of the FET. The output voltage V_{BAT} will be reduced.

If, for instance, V_{IN} will decrease (e.g. U_{MAINS} is 180 V i.s.o. 240 V), the slope of the drain-current will be flattened, through which the FET will be longer into conductance, keeping V_{OUT} constant.

If, for any reason, the stabilisation circuit might fail, the output voltage V_{BAT} can never exceed 200 V (via D6514). D6514 will form a shortcircuit, V_{BAT} will drop and the set will switch off (this will result in an audible hiccuping of the supply).

Set to 'STANDBY" (via RC):
When the set is switched to 'STANDBY' via the Remote Control, the Main supply will be switched off.
This is done by the circuit around TS7529 (see diagram A1):
During 'ON'-state the Main supply is fed with line pulses via the STANDBY line. They are rectified and smoothed via D6517, D6516 and C2530 and fed to TS7529. Because they are less than -20 V, this transistor will be blocked.
When these pulses are stopped (STANDBY), TS7529 will be saturated and TS7502 will be switched off. This will switch off the Main supply.

Set to 'ON' (via 'STANDBY'):
At the moment the set is switched 'ON', the HOP is not working (as much as possible IC's are made voltageless during 'STANDBY'). Therefore it is impossible that the STANDBY line carries line-pulses, so the main supply cannot start up. This problem is solved via the 'low power start-up' possibility of the HOP.
Via pin 22, the HOP receives, via the STANDBY_INFO line from the OTC, a voltage of 5.2 V coming from the Standby supply. The result will be that the HOP will generate pulses with a nominal T_{OFF} and T_{ON} growing from 0 to 30 % of the nominal value.
This signal is unchanged until the Main supply is switched 'ON' and the HOP the correct I^2C-command POR-bit) has received.

Guarding circuit:
The negative pulses on the secondary winding of L5506 are rectified by D6520 and smoothed by C2535. The resulting negative DC-voltage will keep TS7510 blocked, even as TS7511.

When something happens in the Main supply through which these pulses will decrease, the DC-voltage will increase. TS7510 starts to conduct, even as TS7511. Via R3541 and D6522 this situation will be maintained (thyristor principle). The collector of TS7511 drives via R3538 a positive pulse back to the OTC (named STANDBY(POR)). The OTC will now switch off the Main supply via the STANDBY_INFO signal.

SSB

There are 5 different voltages located on the SSB: +33 V, +11D V, +8 V, +5.2 V and +5 V.
+5.2 V is the Standby voltage, it should always be present. The 8 V is derived from the 11D V with stabiliser 7906. The 11D voltage is only present when the line-drive pulses start the deflection.
The 8 V is used to switch the +5.2 V with transistor 7905 to supply the +5 V.

9.1.4 Control (diagram B5)

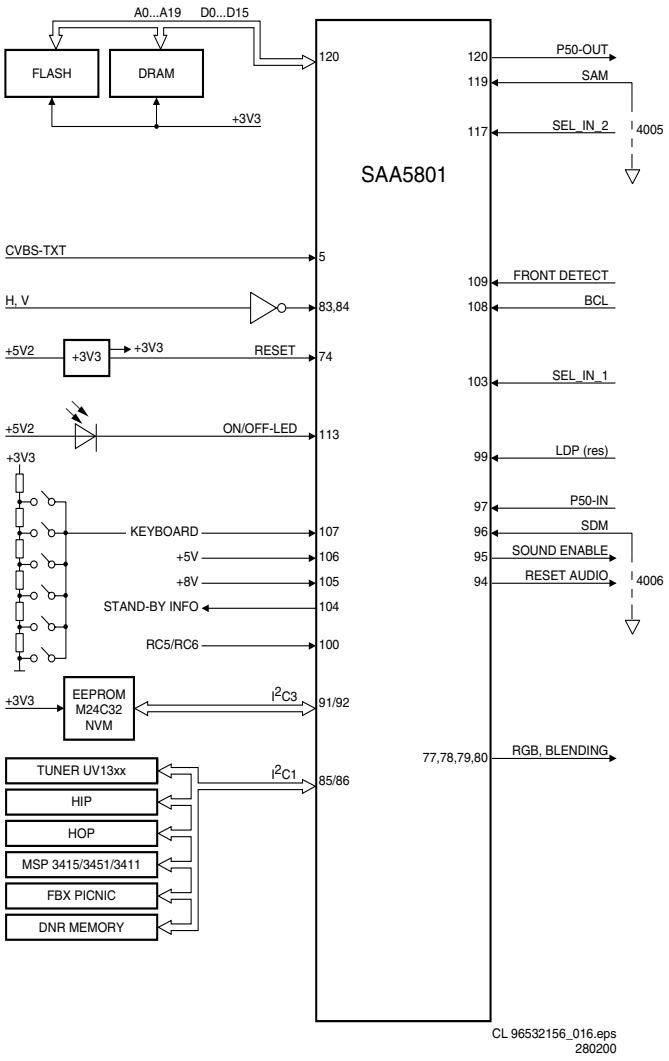

Figure 9-7

OTC

The SAA5801 (IC7001) is called the OTC (OSD, TXT and Control). In this IC, the microprocessor and the TXT-decoder (level 2.5) are integrated.
Some of its functions are:

- Set control.
- TXT/OSD acquisition.
- RGB-outputs to the HOP
- Menu blending; for blending the contrast is software controlled.
- I/O-ports for I^2C, RC5, LED, and service modes.
- Error code generation.

The software for EM2E can be 2 MB (Megabyte).
For TXT-data 1000 pages can be stored in IC7007. This is a DRAM of 4 Mbit and this IC is also used to store data of a working set.
The Non Volatile Memory IC7011 is a 4 kB version M24C32W6.

All ICs in this part are supplied with 3V3. For this voltage a 3V3 stabiliser is used (IC7005).
When the 3.3 V is available, a POR is generated with TS7003/7004 to wake up the OTC. During the reset all I/O pins are high. When a POR is generated the TV-set is in Standby mode.

Via pins 105 and 106 the 8 V and the 5 V are sensed. If one of them is not present, the Main supply is switched off (set in protection and the red LED will blink at 3 Hz). The OTC will generate an error code to indicate what was wrong.

The horizontal (HD100) and vertical (VSYNC) sync pulses are also fed to the OTC for stable OSD and TXT.

The RGB-outputs (77/78/79) together with fading (pin 80) are fed to the HOP. The fading pin has a double function: it is used for making a transparent menu and as fast-blanking signal for TXT.

I^2C-busses

In the EM2E-chassis with OTC-processor there are two I^2C-busses used:

- Slow (max. 100 kHz) hardware I^2C-bus (called I^2C1), used for all IC communication.
- Separate short bus (called I^2C3) for the Non Volatile Memory (NVM) to avoid data corruption.

NVM

The Non Volatile Memory contains all set related data that must be kept permanently, such as:

- Software identification.
- Operational hours.
- Error-codes.
- Option codes.
- All factory alignments.
- Last Status items for the customer + a complete factory recall.
- Txt featuring (keeping habit watch data).
- EPG data.

9.1.5 Tuner & IF (diagram A7 & B2)

The tuner UV1316 is I^2C-controlled and is capable of receiving off-air, S- (cable) and Hyperband channels:

- Low 44 - 156 MHz
- Mid 156 - 441 MHz
- High 141 - 865 MHz

The tuning is done via I^2C. The reference voltage on pin 9 is 33 V. This voltage is derived from the 180 V (from the LOT) via a resistor of 120 kΩ and a zenerdiode. The OTC together with the HIP control the tuning procedure. There is also automatic switching for the different video systems.

The IF-filter is integrated in a SAW (Surface Acoustic Wave) filter. The type of this filter is depending of the standard(s) that has to be received. Two SAW filters are used: One for filtering picture-IF and the second-one for sound-IF. An extra filter (5403), tuned at 40.4 MHz, is necessary for L/L' sets with 6.5 MHz sound to suppress the neighbour channel.

The output of the tuner is controlled via an IF-amplifier with AGC-control. This is a voltage feedback from pin 62 of the HIP to pin 1 of the tuner. AGC take-over point is adjusted via the service alignment mode 'Tuner AGC'. If there is too much noise in the picture, then it could be that the AGC setting is wrong. The AGC-setting could also be mis-aligned if the picture deforms with perfect signal. The IF-amplifier amplifies too much.

The video IF-signal is fed to pins 2/3 of the PLL-controlled IF-demodulator. The voltage controlled oscillator of the PLL is adjusted via the service menu 'IF AFC'. If the alignment is correct then the displayed frequency in the installation menu is the same as the applied frequency from a generator. The external coil L5408 connected between pins 7/8 is used as reference. The demodulated IF-video signal is available at pin

10 of the HIP. In this video signal there is a rest of sound carrier, which is filtered by the sound trap 1407.
Then the signal is again fed to the HIP on pin 12 where the group delay can be corrected, dependent on the standard that is received. On pin 13 the CVBS-signal becomes available which is used for further processing in the television. Via TS7322 the signal is supplied to EXT1 and back into the HIP on pin 14 to the source/record selection.

To realise quasi split sound the IF-signal is fed to the HIP on pin 63/64 via SAW-filter 1405. The FM (or AM for L-norm) - modulated signal is available on pin 5 and is fed to the audio demodulator MSP34xx.

9.1.6 Video: High-end Input Processor (HIP, diagram B2))

In the EM2E the TDA932xH input processor is used, which contains the following functions:
- IF demodulation.
- Group delay correction.
- AFC signal generation, used to track drifting transmitters.
- Sound carrier re-generation (SIF).
- AM demodulation.
- Sync acquisition, delivering HA and VA.
- Switching off IF-filtering.

The HIP has various inputs.
- Full matrix switch with:
  - 2 CVBS inputs
  - 2 Y/C (or additional CVBS) inputs
  - 1 CVBS front end input
- Two RGB inputs and 2 status-inputs

Outputs: Three separate switchable outputs can be used:
- 1 YUV-output is fed to the PICNIC
- 2 CVBS outputs: One for Teletext Dual Screen and the other for output to EXT2 to have WYSIWYR (What you see is what you record)

I/O-switching: The external signals are fed directly to the I/O part of the HIP with status from pin 8 of SCART. On the HIP there are two status inputs available (pins 15, 17) with two voltage levels:
- 4:3 -> 2.2 V
- 16:9 -> 5.5 V

The input signals from the Front I/O are fed to the HIP and front detection is also fed to the OTC.
EXT1 is full SCART: thus CVBS and RGB. The RGB-selection is done in the HIP.
EXT2 is meant for VCR and has therefore some additional signals in relation to EXT1 but no RGB. EXT2 has also the possibility for Y/C_in and Easylink-Plus (P50). Y_in is with pin 20 and Chroma in with pin 15. Easylink is handled via pin 10 of the SCART and this is a bi-directional communication.

Easylink supports the next features:
- Signal quality and aspect ratio matching
- One touch play
- One touch text
- PIP
- Pre-set download
- WYSIWYR
- Automatic Standby

With Easylink-Plus is added:
- Country and language installation
- System Standby
- Intelligent set top box features
- NexTView download
- Timer record control
- VCR control feature

Video processing
The sandcastle-pulse of the HIP will not be used for synchronisation. The HOP will generate synchronisation signal derived from the feature box (PICNIC) signals. If a VCR is connected, there is also an automatic correction for Macrovision. This is active for the external sources and the pre-sets 0, 90-99.
The HIP itself (no external voltage) controls the Y/C switch in the HIP.
The chrominance decoder in the HIP is full multistandard: PAL/SECAM/NTSC.
Two different crystals can be connected to the pins 54 & 57 without any alignment. The crystals are also used as a reference for the synchronisation. A digital control circuit that is locked to the reference signal of the colour decoder determines the start-up of the sync. This crystal may only be replaced by the original one. If just a crystal is taken, the internal capacitance will be different and the effect will be that there is no colour.
In the HIP a sync separation has been integrated; the HIP delivers the HA and VA 50Hz/60Hz to the PICNIC. On pin 59 there is the 1fH sandcastle but this is not connected to any circuit and only used internally for the colour demodulator. The 2fH-sandcastle signal is generated by the HOP.

9.1.7 Video: Feature box (PICNIC, diagram B3))

Introduction
The basic function of the Feature box (FBX6) is picture improvement, and depending on the version, several scan conversion methods can be applied. The PICNIC (SAA4978H) is the central key component.
In the EM2E-chassis the featurebox is integrated on the SSB. The PICNIC is used for the 100Hz conversion. In the PICNIC the following functions are present:
- The ADC.
- The DAC.
- The 100 Hz conversion.
- The Panorama mode.
- The noise limiter (DNR).
- The contrast improvement.

All these functions are integrated in one IC: SAA4978H, 160 pins QFP

ADC/DAC
Analogue to Digital conversion is done with three identical 9-bit ADC's.
Digital to Analogue conversion uses three identical 10-bit DAC's.
In the PICNIC there are three 9 bits ADCs present for Y,U,V. For digitising the Y (luminance) 9 bits are used, to realise a more detailed picture. The 9 bits are only internally used. Via dithering the 9 bits are reduced to 8 bits and that data is stored into the memory. The data in the memory is fed back to the PICNIC and via undithering the data is again reproduced 9 bits for processing.
U/V (colour difference signals) is also sampled with 9 bits. These two 9 bit data streams are multiplexed to 4 bits data streams. This reduction can be allowed, as the perception for colours by the human eye is less sensitive as for luminance.

100 Hz conversion
The main task of the PICNIC is the conversion from 50Hz to 100Hz for YUV and HV-sync. In order to remove 'large area flicker' (especially visible in a white picture), the field-rate of the video is doubled by the FBX6. A 50/60 Hz frame frequency is converted to 100/120 Hz. Also the line frequency (16 kHz) is doubled (32 kHz). Basically, when the video input contains fields A, B etc..., the conversion provides an AABB sequence on the display. The actual conversion is done in the first Field Memory by reading it twice at double speed, while writing it once.

PROZONIC

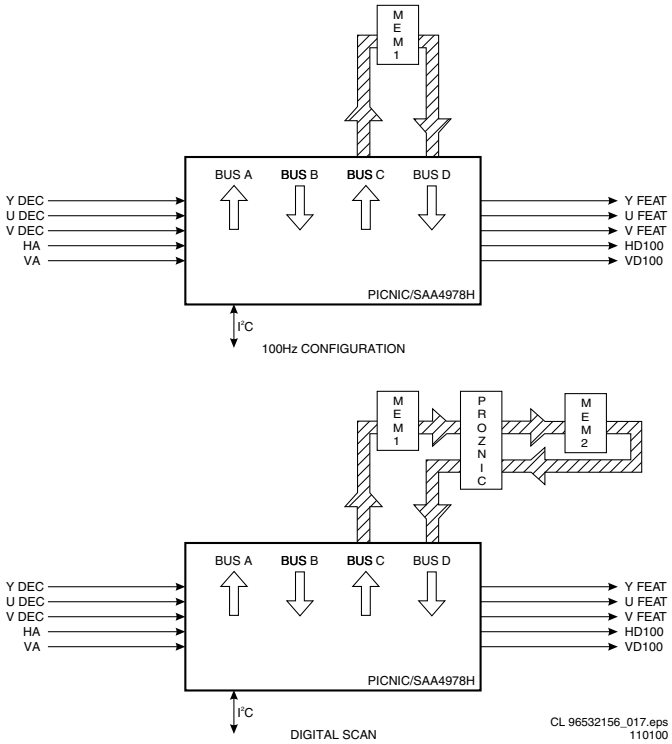

Figure 9-8

To the PICNIC external IC's are connected dependent of the features.
If EM2E has only 100Hz then only one memory-IC is used to store one frame.
For sets with Digital Scan the PROZONIC (IC7708, SAA4990H) has been added with two memory-ICs (IC7714/ 7715). It is an abbreviation for PROgressive scan Zoom and Noise reduction IC.
When applying this, the 2nd Field Memory has to be installed.
The following functions are available:

- Line flicker reduction (Digital Scan): this is a feature to reduce the 25 Hz interlace line flicker.
- Dynamic Noise Reduction: noise affected signals can be improved by combining the pixel values of the current and past video fields. This is however only possible in areas without movement.
- Variable Vertical Sample Rate Conversion
- Synchronous No Parity Eight bit Reception an Transmission interface (SNERT-bus)

Depending on the chassis model, the FBX6 can have the following specification:

Featurebox 6 diversity	
Set	Chipset
EMG 1fH	
EMG 2fH	1 Memory
EMG 2fH DNR	1 Memory incl. DNR
EMG 2fH Dig. Scan	PROZONIC + 2 Memories

Dual Screen compression
The PICNIC can provide horizontal video compression up to 50 %. The compress mode can be used to display dual screens for instance with Teletext (only for widescreen sets).

Panorama
To fit 4:3 pictures into a 16:9 display, a panoramic horizontal distortion can be applied to make a screen-fitting picture without having black sidebars or lost video.

The centre horizontal gain is programmable and the side gain is automatically adapted to make a screen-fit.

Automatic Aspect Ratio Adaptation (AARA)
This feature uses data from the 'black bar detection circuit' to adapt the vertical and horizontal amplitude to an aspect ratio belonging to the display without showing the black bars.

CTI
At CVBS video signals, the bandwidth of colour signals is limited to 1/4 of the luminance bandwidth. Transients between areas of different colours are therefore not very sharp. The PICNIC can steepen these transients artificially with a time manipulation algorithm.

Dynamic Contrast
To make the contrast (black/white) range wider, Philips has invented Dynamic Contrast. It uses the digital memory used in 100 Hz sets. It measures every A-field (25x/s) and digitally analyses where on the greyscale most of the image is located. If it's a relatively dark image, the lighter part of that image is stretched towards white, so that more contrast will become visible in that picture. If it's a relatively light image, the darker part of that image is stretched towards black, so that these darker parts will have more contrast. When the image is in the middle of the greyscale, both dark and light parts are stretched.

9.1.8 Video: High-end Output Processor (HOP, diagram B4)

General
In the HOP (High-end Output Processor, TDA9330) the video processor and digital deflection processor are integrated. The main functions of the HOP are:

- Video control (contrast, brightness, saturation, etc.).
- 2nd RGB interface for OSD/TXT.
- Peak White Limiting.
- Cut-off control and White Drive (RGB outputs).
- Geometry control.

The YUV-signals from the PICNIC are fed to the HOP. In the HOP, the video and geometry control parts are integrated. Also the RGB-signals from TXT/OSD are inserted via the HOP. This IC has all functions from a video processor and geometry control (like the DDP in MD2). The geometry part delivers the H-drive, EW-drive and also a drive signal for rotation. The internal V-drive circuit of the HOP is not used (is explained further on).

Video Control
After conversion to RGB again, the signals can be controlled for Saturation, Contrast and Brightness.

2nd RGB interface for OSD/TXT
On pins 35 - 38 the RGB and fast blanking from the OTC (OSD and TXT) are inserted.

Peak White Limiting
On pin 43 there is a Peak White Limiting signal line (PWL). If the beam current (EHT-info line) increases, then the EHT-info voltage will decrease. PWL is controlled by average limiting via R3343/C2333.

Cut-off control
Switching the TV to Standby:

1. Vertical scan is completed.
2. Vertical flyback is completed (the horizontal output is gated with the flyback pulse, so that the horizontal output transistor cannot be switched on during the flyback pulse).
3. Slow stop of the horizontal output is started, by gradually reducing the 'on' time at the horizontal output from nominal to zero (this will take 50 ms).

4. At the same time the fixed beam current is forced via the black current loop for 25 ms. This is done by setting the RGB outputs to a maximum voltage of 5.6V.

In the EM2E a 'one-point' cut-off control is used:
A current of 8 µA (for cut-off) is fed to pin 44 of the HOP. This is done with a measurement pulse during the frame flyback. During the 1st frame, 3 pulses are generated to adjust the cut-off voltage at a current of 8 µA.With this measurement the black level at the RGB-outputs is adjusted. So at start-up there is no monitor pulse anymore. At start-up, the HOP measures the pulses which come back via pin 44. The RGB-outputs have to be between 1.5 V and 3.5 V. If one of the outputs is higher than 3.5 V or one of them lower then 1.5 V, the RGB-outputs will be blanked.

Geometry control
All geometry control is done via I^2C and the data is stored in the NVM (IC7011) of the SSB.

Line drive (LINEDRIVE1).
Line drive is derived from an internal VCO of 13.75 MHz. As a reference an external resonator is used (1301). The internal VCO is locked with the HD100-pulse, which comes from the PICNIC. The 'PHI-2' part in the HOP receives the HFB_X-RAY_PROT (pin 13) to correct the phase of the line drive. The EHT-info is supplied to pin 14 (DYN-PHASE-CORR) to compensate picture breathing depending on the beam current. Service tip: This is not used at the moment, therefore EHT-compensation in the service menu is put to zero.

Frame drive (FRAMEDRIVE+).
The VD100 signal from the PICNIC will be extended for 16.5 lines by the circuit around TS7309 and 7311. The resulting signal (VDHOP) will drive TS7310. This will result in the (asymmetric) FRAMEDRIVE+ signal.
Note: The Frame outputs (pins 1/2) of the HOP are not used!

East/West drive.
At pin 3 the E/W-drive is available. Pin 4 is a feedback input for the EHT-info and is used to prevent pumping of the picture. EHT varies also dependent of the beam current. For widescreen without load this is 31.5 kV and with load (1.5 mA) 29.5 kV.

Frame rotation (only for 16:9 sets):
For frame rotation a control voltage is used from pin 25 of the HOP. This voltage can vary from 0.4 V till 4 V.

Guarding protections:
- Flash detection:

When a flash occurs, the EHT-info will become negative very fast. Via D6303/D6304/R3316, TS7303 starts to conduct. This makes pin 5 of HOP high. When pin 5 of HOP is high, then the output (pin 8) is immediately stopped. If H-drive stops then also pin 5 will be low again, which will reset the flash detection. A bit (FLS) will be set in an output status register, so via the OTC it can be seen when there was a flash. This FLS-bit will be reset when the OTC has read that register.
- HFB protection:

If the HFB is not present then this detected via the HOP. The OTC puts the TV into protection and reads a register in the HOP. An error code will be generated.

9.1.9 Synchronisation (diagram B3 & B4)

The HIP video processor provides vertical and horizontal sync pulses VA and HA that are synchronised with the incoming CVBS signal. These pulses are fed to the PICNIC where they are doubled to be synchronous with the 100 Hz picture. The outgoing pulses, VD100 and HD100 are fed to the HOP that supplies the vertical and horizontal drive pulses and the 100 Hz (2fH) sandcastle pulse.

The VD100 pulse from the PICNIC is only one line long. Therefore this pulse is converted into a VDHOP signal by a 530 µs monostable oscillator (extended by 16.5 lines). This signal is on block function level equal to VSYNC and FRAMEDRIVE+.

The OTC is synchronised on the HD100 pulse from the FBX and on the VSYNC for the synchronisation of TXT/OSD/EPG

When no CVBS is offered to the video processor, the VA and HA pulses are switched off by the HIP, and the VD and HD pulses are then generated by the PICNIC. This to assure a stable OSD.

9.1.10 Horizontal (line) deflection (diagram A3)

Driving the line output stage

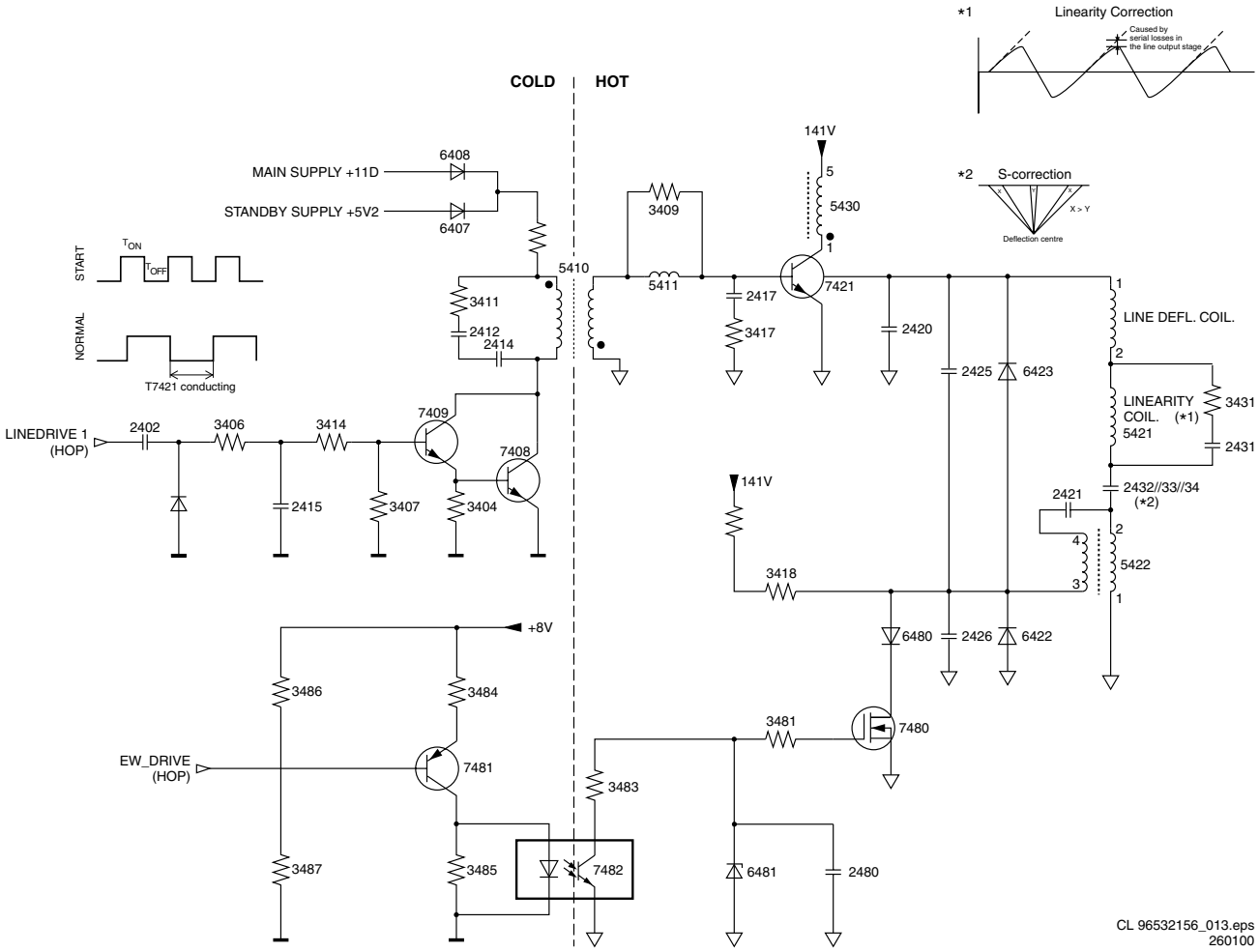

Figure 9-9

The HOP (located on the SSB) generates the line-drive pulses (LINEDRIVE1), which have a frequency of 31250 Hz (T = 32 µs).

When the LINEDRIVE1 signal is high, TS7409 and TS7408 will conduct. A constant DC voltage will be applied across L5410, causing a linear increasing current through this coil. The secondary voltage of L5410 has a negative polarity so that TS7421 will block. When switching on the set, the current through L5410 is supplied by the 5V2 Standby supply (via D6407), and taken over by the +11D voltage (via D6408) of the main supply.

When the LINEDRIVE1 signal becomes low, TS7409 and TS7408 will block. The voltage polarity across the primary winding of L5410 will invert. The positive voltage on the secondary winding will now drive TS7421 into conductivity. Because of the storage time of the line transistor (TS7421), L5410 cannot transfer its energy immediately to the secondary side. This may result in high voltage peaks on the collector of TS7409 and TS7408. To prevent that these peaks will damage the transistors, a 'snubber' circuit (C2414, C2412 and R3411) will suppress them.

When the LINEDRIVE1 signal is high again, the above-described sequence starts again. Circuit L5411 and R3409 will increase the switch-off time of the line transistor.

The line stage will be started via the 'slow start' principle. During start-up, the HOP generates line drive pulses with a small T_{ON} and a high frequency (50 kHz); T_{OFF} will be constant and T_{ON} will be gradually increased until the duty-cycle is 50 % (normal condition). The time interval from start to normal condition takes about 150 ms. When switching off, the same procedure is followed, but now in reverse order.

Operation of the line output stage

To explain the operation of the line output stage, we use the following start conditions:

- C2433 is charged to max. 141 V (V_{BAT})
- TS7421 is driven into conductivity.

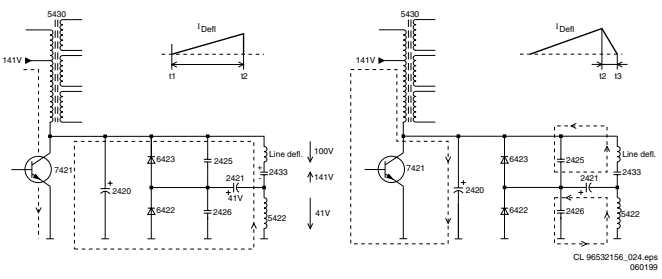

Figure 9-10

Period t1 - t2:
When TS7421 is driven into conductivity, the capacitor voltage of 141 V, will be divided across bridgecoil L5422 and the deflection coil (conn. 0317). Due to the chosen inductance values, there will be 100 V across the deflection coil and 41 V across L5422. The linear increasing current in the deflection coil will result in a spot moving from the centre of the picture tube to the right.
The voltage across L5422 will also charge C2421 (41 V - 0.7 V).

Period t2 - t3:
At the moment the LINEDRIVE signal becomes high, TS7421 will stop conducting. In the coils a voltage will be induced, trying to maintain the current. The current through the line deflection coils continues to flow through C2425 and C2421 and the current through L5422 continues to flow through C2426 and C2421. The energy stored in the line deflection coil is passed to C2425, and the energy of L5422 to C2426.
The resonance-frequencies of these 2 LC-circuits define the flyback time of the spot from the right side of the picture tube to the left.
On average no current flows through C2421 and thus the voltage across this capacitor remains constant.

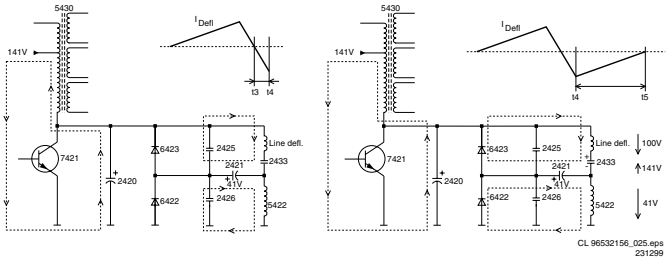

Figure 9-11

Period t3 - t4:
As for the period t2 - t3; but now the current flows in the opposite direction, since the voltage across C2425 and C2426 is higher than the voltage across C2433 and C2421.

Period t4 - t5:
The coils want to maintain the negative current and will charge the capacitors negative. Because of this, D6422 and D6423 will conduct. The voltage is 100 V across the deflection coil and 41 V across L5422. As both diodes conduct, we may consider the voltage to be constant. A linear current flows with the same changing characteristics as in period t1 - t2. The spot now moves from the extreme left of the picture tube to the centre. Before the current becomes zero, and the spot is located in the centre of the frame, TS7421 reverts back into conductivity. First a short negative current will flow. The cycle starts again.

The linearity correction
A constant voltage across the horizontal deflection coil should result in a linear increasing saw-tooth current. This however is not the case as the resistance of the coil is not negligible. In order to compensate for this, a pre-magnetised coil L5421 in series with the deflection coil is used. This coil ensures that during time interval t1 - t3 the circuit-resistance will be higher than during t4 - t5. L5421 is called the linearity coil.
To avoid self-oscillation, R3431 and C2431 are placed parallel to L5421.

The S-correction
Since the sides of the picture are further away from the point of deflection than the centre, a linear saw-tooth current would result in a non-linear image (the centre would be scanned slower than the sides). To solve this, the deflection current for the right- and left side will be reduced.
C2433 is charged quadratic during time interval t1 - t2. Left and right the voltage across the deflection coil decreases, causing the deflection to slow down. In the centre, the voltage increases and the deflection will be faster. An S-shaped current will have to be superimposed onto the saw-tooth current. This correction is called finger-length correction or S-correction. C2433 is relatively small, as a result of which the saw-tooth current will generate a parabolic voltage with negative voltage peaks.. The current also results in a parabolic voltage across C2421, resulting in the finger-length correction, proportionally increasing with the picture width. The EW-DRIVE signal will ensure the largest picture width in the centre of the frame. Here the largest correction is applied. The larger the picture width, the higher the deflection current through C2433.

The E/W-correction
A line, written at the upper- or lower side of the screen, will be larger at the screen centre when a fixed deflection current is used. Therefore the amplitude of the deflection current must be increased when the spot approaches the screen centre. This is called East/West correction.
The EW-DRIVE signal is generated in the HOP and will drive FET TS7480 via TS7481 and optocoupler TS7482. TS7480 will charge capacitor C2423 more or less, increasing the deflection current when reaching the centre of the screen.

Secondary line-voltages
During the blocking time of TS7421, the magnetic energy of coil 1 - 5 of the LOT will be transferred to electrical energy in the secondary winding. Via rectifying and smoothing, the several secondary supply voltages will be generated:
- EHT, Focus and Vg2-voltage
- +180V for the CRT panel (pin 8 LOT)
- +11D for the line deflection (pin 12 LOT)
- +13VLOT for the frame deflection (pin 6 LOT)
- -15VLOT for the frame deflection (pin 3 LOT)
- Filament voltage (pin 9 LOT)

The EHT-INFO signal is derived via R3450//R3451. This signal decreases while the beam current increases. It is fed to the HOP to compensate for loss of picture width and picture height.

The DYN-FASE-CORR signal is fed to the HOP via C2455 and drives a dynamic phase correction necessary because of beam current variations. This is done by regulating T_{ON} of the line transistor TS7421.

East-West circuit
The moment TS7480 is driven into saturation, C2421 will discharge during the flyback. As a consequence of which C2421 must be charged again during the scan via the conduction diode D6422 (as long as C2421 is not charged to the voltage across L5422, D6422 will conduct). The current in the deflection coil is therefore larger than the current flowing in L5422 (1-2). The voltage across the deflection coil increases, so the picture width increases. When TS7480 blocks, C2421 will not discharge anymore and the voltage across C2421 will remain constant. The result is that the voltage across the deflection coil is minimal. The voltage across coil L5422, however, is maximal. This coil (L5422) consists of a transformer:
- As the current through the coil 1-2 increases (smaller picture width), the current through coil 3-4 decreases. Because of the transformer characteristic a higher voltage will be subjected to coil 3-4, which will counteract the current. The current will diminish even further.
- When the current through coil 1-2 diminishes (larger picture width), the current through coil 3-4 increases.

The EW Drive

The EW drive signal originates in the HOP and is supplied to TS7480. The shape of this signal determines the various geometric correction parameters:

- H amplitude
- EW-parabola
- EW-corner
- EW-trapezium
- Horizontal parallelogram
- Horizontal bow

Beam current correction

The EHT-info at point 10 of the LOT is dependent on the value of the beam current and the voltage divider R3450, R3451 and C2450. The EHT-info is fed to the HOP to trim the contrast and to compensate for the changes in picture-width as a function of the EHT-info, when the high-voltage is decreased. The EHT-info is integrated via C2450 and sent to the gate of the E/W FET (TS7480) as a DC-voltage to correct the EW-current.

9.1.11 Vertical (frame) deflection (diagram A4)

Driving the frame output stage

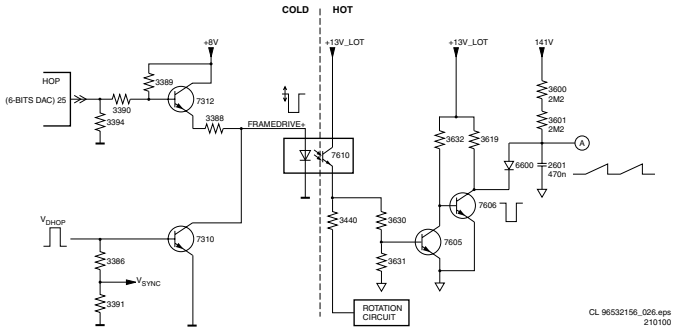

Figure 9-12

The HOP drives the frame output stage. As the HOP is 'cold' and the frame output stage is 'hot', they must be galvanic isolated by means of an optocoupler. In the MG-chassis the HOP generates 3 signals needed for the frame output stage: VDPOS, VDNEG and FRAME ROTATION. To avoid the costs of 3 optocouplers, the frame drive pulse and rotation DC-voltage are added together and then fed to optocoupler TS7610.

This is done as follows: The VD100 signal from the PICNIC (diagram B3 pin 19) is extended for 16.5 lines and inverted via a monostable multivibrator (TS7311 & TS7309, diagram B4). The output signal VDHOP is then superimposed on a DC-voltage from pin 25 of the HOP. The resulting signal is called FRAMEDRIVE+ and is fed to optocoupler 7610 (diagram A4). So this signal contains info for both the frame deflection and the frame rotation.

The circuit around IC7440 will amplify this signal and the output current will flow through the rotation coil. The vertical pulses on this signal are filtered by C2445 to ensure that only a DC-voltage will be supplied to the rotation coil.
The output voltage of the rotation circuit is between -8 and +8 V.

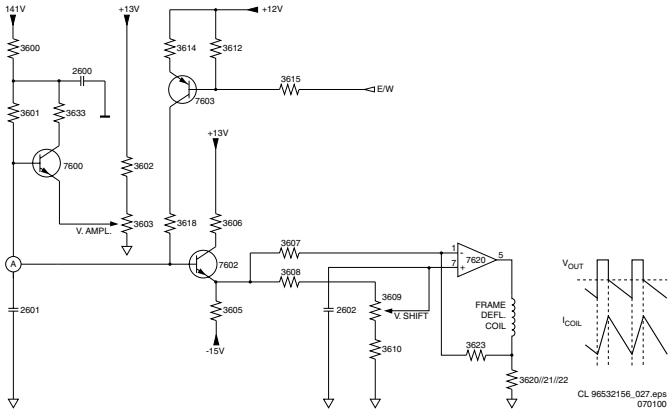

Figure 9-13

The sawtooth voltage for the frame output stage is not generated by the HOP but by a discrete circuit after the optocoupler 7610: via R3600 and R3601 a linear increasing voltage over C2601 is built up with a large time constant.

The circuit around TS7603 is a current source, driving C2601 with a current value derived from the E/W modulator. This will result in an S-shaped voltage on C2601 (also known as EW-correction).

Flyback generator

The frame output stage is supplied via the +13 V and -15 V coming from the LOT. The output of the amplifier is 0 V_{DC}, so a coupling capacitor is not required.

During the (forward) scan, a supply of +13 and -15 V is sufficient to respond to the slow changing current. The flyback generator puts a voltage of -15 V on pin 3. Because of the voltage drop over zenerdiode D6622 (8.2 V), C2622 will be charged to 19 V: being 13 + (15 - 8.2 - 0.7) V.
During the flyback scan, the change in current per time is much larger, so a higher voltage is required. The flyback generator will now generate a voltage of +13 V on pin 3. Added to the charge on C2622 this will give a flyback voltage of 32 V (depending on the CRT size, this value can differ).

The IC amplifier (IC7620, pin 5) supplies the sawtooth current to the frame deflection coil. The current through this coil is measured via R3620//R3621//R3622 and fed back to the inverting input of the amplifier.
R3624 and C2624 on the output of the amplifier, form a filter for high frequencies and in that way also prevents oscillations. Peak voltages on the output, e.g. as a result of a possible flash, are damped by the clamp circuit consisting of D6619, C2627 and R3627. The network consisting of R3625, R3629 and C2629 form an extra damping circuit.

Protection circuit for bridge-coil and frame output stage

The secondary voltage of bridge coil L5422 is guarded at the diode modulator (D6421/22) via a detection circuit consisting of an 8.2 V zenerdiode (diagram A3). When the bridge-coil is working properly, the average voltage on D6422 is such that this zenerdiode will conduct and will drive TS7652 into saturation via the BRIDGE_PROT signal (see diagram A4). When, for any reason, the secondary side of the bridge-coil is shorted, the average voltage on D6422 will drop below the zener-voltage and TS7652 will block. Now capacitor C2642 will be charged. Transistor TS7407 will start conducting and the STANDBY signal will be grounded via R3403. This will switch off the main supply (see diagram A1).

Via the circuit built around TS7641 the frame output stage is guarded. If the frame output stage is working properly, TS7641 and TS7652 will both conduct and thereby discharging C2642. TS7407 is blocked now, causing the STANDBY signal to be high-ohmic.
If there are frame pulses missing, TS7641 will block and capacitor C2642 can be charged. Transistor TS7407 will now start conducting and the STANDBY signal will be grounded via R3403. This will switch off the main supply (see diagram A1).

9.1.12 Audio (diagram B6, A5 & A6)

Introduction
All EM2E sets contain one of ITT's Multistandard Sound Processing IC's for sound decoding. The diversity arises because each member of the MSP-family handles its own set of sound standards:
- MSP3415D: Europe & AP decoding, Stereo incl. NICAM.
- MSP3451G: Global decoding, Virtual Dolby.

This IC takes care of the main FM sound decoding. AM decoding for the L system is done by the HIP. The demodulated L sound is then again source selected and processed in the MSP. The reason for this is the bad AM detection performance of the MSP. In case of NICAM L however, this is handled by the MSP.

All MSP versions contain digital audio processing, used for the basic left/right stereo sound, such as bass, treble, balance, incredible sound and spatial. In addition to that, the MSP3451 is also able to perform Virtual Dolby, a Dolby approved sound mode for surround sound reproduction with left/right speakers only.

Audio source selection
- MSP3515D (stereo)

This IC is an economised version of the MSP3410 that is used in the MG-chassis. It can cover 2 stereo and 1 mono (AM) input. Since more inputs are required, a separate source selector is used (HEF4052, IC7675). This selector has EXT1, EXT2, FRONT and SC1-OUT (Tuner) as input and is connected to the SCART1 input of the MSP3415. The SCART2 input is not used.

Since the MSP3415 has only one SCART output, which is connected to the SCART1, a constant level output and connection to SCART2 is not available. This is fixed by connecting the HEF4052 input selector to the constant level output and to SCART2 via a so-called 'Régimbeau' switch (IC7652).
This switch is needed to prevent feedback (Larsen effect). When EXT2 is chosen as input signal, and the output of SCART2 is selected, this means that the main picture is also EXT2 and will cause the Larsen effect. To prevent this, the record select must be switched to Tuner. This is especially important when decoders are used, behind a 'transparent' VCR connected to EXT2.

To get a constant level output if the Tuner is selected, the SCART1 output (Tuner at any time), has to be fed back to the input selector and selected as input for the MSP (SCART1 input).

The MSP3415 has no separate output to drive a headphone. The headphone is therefore hardwired (on the LSP) to the main sound output.

- MSP3451G (Virtual Dolby)

The MSP3451, which is used in all versions supporting Virtual Dolby, is capable of supporting 4 stereo inputs and 1 mono (AM) INPUT. Therefore the extra input selector (HEF4052) is not needed.

The MSP3451 is also capable of supporting 2 SCART outputs, so the trick used in the MSP3415 set-up to get a constant level output is not needed.

The MSP3451 has a separate headphone output, so sound control be done separate from the speakers.

Audio decoding
At the input a choice can be made between two IF-signals; SIF and SIFM.
The selected signal is fed to the AGC. After this, an ADC converts the IF-signal to digital.

This digital signal can be processed by 2 demodulation channels. The first one is able to handle FM and NICAM signals. The second one can handle FM and AM signals.

Each channel contains a mixer to shift the incoming signal in the frequency domain. This shift is determined by the value of a DCO.

After the down-mix, the signal is fed, via a filter, to a discriminator. From here the AM, FM or NICAM demodulation can be performed.

Both channels contain an 'automatic carrier mute' function, which automatically mutes the output of the analogue section when no carrier is detected.

After demodulation, the FM-signals are subjected to a de-emphasis operation. After that the matrix of the stereo system is applied.

Audio processing
The sound processing in EM2E is completely done by the MSP3415D for 'Stereo' sets or the MSP3451G for 'Virtual Dolby' sets:
- Volume control is done by the user via the SOUND menu.
- Tone control in 'Stereo' sets is done via the BASS/TREBLE control, in 'Virtual Dolby' sets via the 5-band equaliser.
- Headphone control in 'Stereo'-sets is done via the loudspeaker output of the MSP, no sound control possible. In 'Virtual Dolby'-sets, the MSP has a separate Headphone output so separate sound control is possible.
- Mute control can be done in different ways:
  - Via the SOUND_ENABLE line of the OTC. Used during start-up/switch-off conditions, in order to avoid audible plops.
  - Via the decoding part of the MSP.
  - Via the processing part of the MSP.

The mute on the RC or in the UI is per today a combination of processing mute and SOUND_ENABLE line. When a user mute is done, the processing mute will turn down the volume, after which the SOUND_ENABLE line is switched. De-muting is the other way around. The reasons for this is a technical problem with crosstalk of the headphone into the loudspeakers.

Automatic Volume Levelling (AVL)
One of the features of the MSP-family is AVL. If used, it limits the big volume differences in the broadcast between e.g. news transmissions and commercials or within a movie.
To be able to get a Dolby approval (for the Virtual Dolby sets), the AVL feature must be switchable. Therefore, the AVL feature is customer switchable via the menu.

Audio amplification
The audio amplifier part is very straight forward. It uses an integrated power amplifier IC, the TDA2616. It delivers an

output of 2 x 10 WRMS to 2 full range speakers. A subwoofer is not implemented.

The supply voltage is +28 V, generated by the main supply via L5506.

Muting is done via the SOUND-ENABLE line connected to pin 2 of the amplifier-IC and coming from the OTC. This signal is inverted by TS7730, as a result of which at a high level of the SOUND-ENABLE signal, current is sinked from pin 2 and the IC mutes.

9.1.13 Teletext / NexTView (diagram B5)

Teletext

The TXT-decoder in the OTC gets its video signal directly on pin 5 (from the HIP).
The RGB-outputs are available on pins 77/78/79. Fast blanking is realised via pen 80.
In the previous chassis there was separate memory to store the TXT information. In EM2E the DRAM (IC7007) of the microprocessor is also used for the TXT-decoder.

NexTView

NexTView allows the user to display a program guide on the TV screen that contains extensive information for each program.

This information can be displayed in a number of different summaries:

- DAY: The daily summary shows, from the current moment, the program schedule for several stations for a short time ahead.
- CHANNEL: The channel summary shows the program schedule for one station.
- THEME: The theme summary shows, for each theme, the program schedule of the various stations. These themes consist of sport, film, culture, etc. and is determined from the station side.

NexTView does not have to restrict itself to information about the station that is being viewed, but also offers information about other stations. In the various summaries 3 different commands can be given for the various program overviews. These commands appear as follows:

- WATCH: The set immediately switches over to the station concerned.
- REMINDER: The start time and date and the station of the program concerned is stored in the TV reminder list. The TV will give an OSD-message with the program information, or switch on the set at the correct moment (provided the set is in Standby) and tune to the station concerned.
- RECORD: The timer of the video recorder with ‘Easylink Plus’ is programmed with the data of the program concerned. There has to be a video recorder (with Easylink Plus) connected to SCART2 otherwise the ‘RECORD’ function will not be highlighted. The connection is via pin 10 from SCART. This means that it has to be a full SCART or at least pin 10 has to be wired.

In order to be able to realise NexTView, two teletext type data flows, Data stream 1 and 2, are transmitted with various sub-code pages of information. This data flow can transport limited information (max. 40 pages). Data stream 1 is quick repeating with a repetition time of approximately 20 to 30 seconds. However, Data stream 2 has a much longer repetition time of approximately half an hour and has a large transport capacity.

- Data stream 1 contains information of the station that is being viewed.
- Data stream 2 contains up to one week of advance information from various stations that are covered by the provider.

9.1.14 CRT / SCAVEM / Rotation (diagram F)

RGB amplifiers

On the CRT panel, the RGB amplifier (TDA6108, IC7307) is located. Via the outputs 9, 8 and 7 the cathodes of the picture tube are driven.
The supply voltage for the amplifier is 180 V and is derived from the LOT.

SCAVEM

The SCAVEM-circuitry is implemented in the layout of the picture tube panel. It is thus not an extra module. SCAVEM means SCAn VElocity Modulation. This means that the horizontal deflection is influenced by the picture content. In an ideal square wave, the sides are limited in slope by a limited bandwidth (5 MHz).
SCAVEM will improve the slope as follows: At a positive slope, a SCAVEM-current is generated which supports the deflection current. The first half of the slope the spot is accelerated and the picture is darker, while at the second half of the slope, the spot is delayed and the slope becomes steeper.
At the end of the slope, the SCAVEM-current decays to zero and the spot is at the original position. An overshoot occurs which improves the impression of sharpness. At the negative slope, the SCAVEM-current counteracts the deflection.
During the first half of the slope, the spot is delayed, the slope becomes steeper.
During the second half the spot accelerates, the SCAVEM-current is zero at the end of the slope.

Via the three resistors R33315, R33317 and R3320, Red, Green and Blue are added together and offered to the emitter TS7300. On the collector of this transistor, configured in a common base, the sum of these 3 signals is obtained. Via the emitter follower formed with TS7301, this signal is conveyed to the differentiator C2303, R3309 and R3318. Only the high frequencies are differentiated (small RC-time).
The positive and negative pulses of this signal drive respectively TS7303 and TS7302 into conductivity. The DC setting of the output stage is set by R3304, R3308, R3316 and R3319. The working voltage of the transistors is settled at half the supply voltage.
At the positive section of the pulse, the current flows through R3318, C2307, the SCAVEM-coil and TS7303. At the negative section of the pulse, the current flows through R3318, C2409, the SCAVEM-coil and TS7302.

Rotation

In sets with a rotation coil (widescreen sets ≥ 32"), the amount of frame rotation is adjusted with the DAC-output of the HOP (see also 'Vertical Deflection').

9.1.15 Software related features

Following features are described:

- Smart Local Doming Prevention (SLDP)
- Auto TV
- Switch ON behaviour

Smart Local Doming Prevention (SLDP)

A CRT with an iron shadow mask shows a considerable amount of local doming (due to local heating), resulting in unwanted colour artefacts.
SLDP helps to reduce these artefacts for both 16:9 and 4:3 sets to an acceptable level. It measures the beam current in areas that are sensitive to local doming and reduces the contrast if the beam current in these places exceeds a pre-set threshold. The chosen solution in EM2E, is based on the PICNIC hardware and software and it uses the histogram measurement of the PICNIC to make a prediction of the local heating of the CRT shadow mask.

With SLDP, local doming is diminished to an acceptable level at the cost of contrast reduction. By using a 'smart' solution for a part of the necessary contrast reduction, the resulting picture remains even more acceptable.
SLDP is not a feature. It's an algorithm that diminishes local doming effects. These effects occur whenever iron mask (and in a limited way invar mask) tubes are applied. Therefore, there is no reason to make it switchable for the customer. However, SLDP can be switched off via the Service Alignment Mode (SAM).

AutoTV
The AutoTV (or 'Automatic Picture Control' or 'Active Control') aims at giving the customer the best possible picture performance at any time. Therefor it does real time processing of the video signal and as a result, it decides to adapt several video parameters throughout the whole chassis.

The AutoTV feature integrates traditional picture performance, AutoTV functionality and 'smart controls' in order to come to a kind of 'supersmart' TV. It can be subdivided in:

- Auto Noise Reduction. This algorithm measures the amount of noise in the incoming video signal (this is done by the LIMERIC part of the PICNIC). As a result of this measurement, the amount of noise in the picture is corrected, starting from that noise level which is annoying for the customer. Which parameters exactly can be used is depending on the hardware.
- Auto Sharpness. This algorithm measures the amount of sharpness via the bandwidth of the incoming video signal and adapts the peaking frequency in the PICNIC according to this info. If the 'sharpness meter' sees the video content as 'sharp', high frequency peaking will be used. On the other hand, if the picture content is seen as 'not sharp', a low/mid frequency peaking is used. There is a coupling between the Auto Noise and the Auto Sharpness algorithm: if noise is present in the video content, then in general the sharpness will be made less aggressive. Special care has to be taken to the interaction of the LIMERIC and the vertical peaking of the PICNIC: a too big amount of vertical peaking increases the visibility of the 2DNR artefacts.

In the EM2E a limited AutoTV control function is used: only a combination of above described features is used in the background in order to improve the set performance, specially focussed on noise reduction.

Switch ON behaviour
First of all, the microprocessor needs to start up: After the power is applied, the 'Standby supply' starts oscillating, generating the +5V2 and +3V3. When ready, a reset (POR) is generated and the OTC is awakened.

During reset, the OTC puts a high level on all his outputs, causing the degaussing relay to close. After the reset, the outputs and inputs of the OTC must be initialised to their default state. The degaussing output of the OTC must stay high for 12 seconds.

Next step is the check whether the set needs to be in Standby or not. Therefore, the NVM content is read and the Standby-bit is checked. If the set is to stay in Standby, there is no further action.

If the set has to be switched 'on', the Standby-info line is pulled low. This results in the low power mode start-up of the HOP. The line drive starts to run on 50 kHz, wakes up the main supply and the +5 V, +8 V and +141 V supplies become available. The OTC waits until the +8 V is fully present. This is done by checking the ADC input of the OTC. A positive result means three times a positive +8 V detection in a row (time between each polling approx. 5 ms). If this detection still fails after 1 second, an error should be generated and the set must be switched to protection (error: "+8 V).

After detection of the +8 V, the MSP must be reset, since it can disturb I^2C traffic when not properly reset. From this moment on, I^2C traffic is possible.

To be sure that the HOP is properly started up, the POR bit of the HOP should be read. If this is not successful, the Standby info has to be put high again and an error code (code 11: HOP) will be generated. If the reading of the POR bit is successful, the starting procedure can be continued.

The Standby info line must be switched high again. The sync mode and the black current stabilisation loop of the HOP must be disabled in order to have a smooth start-up. Within 23.5 ms after reading the HOP POR bit, the HOP has to be started up via the HOP_start commando. If this condition is not fulfilled, the HOP will stop his line drive again and the set will not be able to start up.

During start-up of the deflection, I^2C traffic must be disabled for 250 ms to avoid data corruption. If flashes or spikes are generated during EHT start-up, I^2C data could be disturbed or corrupted.

After deflection is powered up completely, all protection algorithms are set active.
The rest of the NVM content can now be read and the IC's can be initialised according this info.

If SLDP is present in the set, an initialisation of SLDP has to be performed, including a calibration of the beamcurrent ADC.

The sync-mode of the HOP must be switched to active and the black current stabilisation loop in the HOP is switched on. Some extra checking is done to ensure that the loops are completely stabilised. Software sets all the necessary parameters for a correct sound and image and unblanks the picture.

A provision is foreseen to avoid sets in the field that will never unblank, if the picture tube is severely worn out. If the black current stabilisation does not become stable within a time frame of 30 seconds, the picture is unblanked anyway

9.2 Abbreviation list

AARA	Automatic Aspect Ratio Adaptation: algorithm that adapts aspect ratio to remove horizontal black bars; keeping up the original aspect ratio
ACI	Automatic Channel Installation: algorithm that installs TV sets directly from cable network by means of a predefined TXT page
ADC	Analogue Digital Converter
AFC	Automatic Frequency Control: control signal used to tune to the correct frequency
AGC	Automatic Gain Control: algorithm that controls the video input of the featurebox
AI	Artificial Intelligence
AM	Amplitude Modulation
ANR	Automatic Noise Reduction: one of the algorithms of Auto TV
AR	Aspect Ratio: 4 by 3 or 16 by 9
Artistic	see OTC 2.5: main processor
ASF	Auto Screen Fit: algorithm that adapts aspect ratio to remove horizontal black bars but without throwing away video information
ATV	See Auto TV
AUDIO_C	Audio Centre
AUDIO_L	Audio Left
AUDIO_R	Audio Right
AUDIO_SL	Audio Surround Left
AUDIO_SW	Audio Subwoofer
AUDIO-L-PROC	Audio left processed
AUDIO-R-PROC	Audio right processed
AUDIO-SR	Audio surround right
Auto TV	Name for the combination of picture features/improvements which work automatically (ANR / Auto sharpness/ Auto Histo/ambient light).
BC-PROT	Beam current protection
BG	System B and G
BLC-INFO	Black current information
B-SC1-IN	Blue SCART1 in
B-SC2-IN	Blue SCART2 in
B-TXT	Blue teletext
CENTER	Centre speaker
C-FRONT	Chrominance front input
CL	Constant Level: audio output to connect with an external amplifier
ComPair	Computer aided rePair
CRT	Cathode Ray Tube or picture tube
CSM	Customer Service Mode
CTI	Colour Transient Improvement: manipulates steepness of chroma transients
CVBS	Composite Video Blanking and Synchronisation
CVBS-SC1-IN	CVBS SCART1 in
CVBS-SC2 OUT	CVBS SCART2 out
CVBS-SC2-IN	CVBS SCART2 in
CVBS-SC3-IN	CVBS SCART3 in
CVBS-SC4-IN	CVBS SCART4 IN
CVBS-TER	CVBS terrestrial
CVBS-TXT-DS-OUT	CBVBS teletext Dual Screen out
CVBS-TXT-OUT	CVBS teletext out
CVBS-Y-FRONT	CVBS luminance front input
DAC-HOP	Digital analogue converter HOP IC
DBE	Dynamic Bass Enhancement: extra low frequency amplification
DC-filament	Filament supply voltage
DC-PROT	DC protection
DFU	Direction For Use: description for the end user
DNR	Digital Noise Reduction: noise reduction feature of the box
DSP	Digital Signal Processing
DST	Dealer Service Tool: special remote control designed for dealers to enter e.g. service mode
DVD	Digital Versatile Disc
DYN-FASE-COR	Dynamic phase correction
EHT	Extra High Tension
EHT-INFO	Extra High Tension information
ELDP	Electrical Local Doming Prevention (only HW)
EPG	Electronic Program Guide: system used by broadcasters to transmit TV guide information (= NexTView)
EW	East West, related to horizontal deflection of the set
EXT	External (source), entering the set via SCART or via cinches
FBL	Fast Blanking: DC signal accompanying RGB signals
FBL-SC1-IN	Fast blanking signal for SCART1 in
FBL-SC2-IN	Fast blanking signal for SCART2 in
FBL-TXT	Fast Blanking Teletext
FBX	Feature Box: part of small signal / separate module which contains 100 Hz processing, extra featuring and AutoTV algorithms
FEAT-U	U from Feature Box
FEAT-V	V from Feature Box
FEAT-Y	Y from Feature Box
FILAMENT	Filament of CRT
FLASH	Flash memory
FM	Field Memory or Frequency Modulation
FMS	Functional Module Specification: document that describes an isolated hardware function
FRONT-C	Front input chrominance (SVHS)
FRONT-DETECT	Front input detection
FRONT-Y_CVBS	Front input luminance or CVBS (SVHS)
FRS	Functional Requirement Specification: software specification document
G-SC1-IN	Green SCART1 in
G-SC2-IN	Green SCART2 in
G-TXT	Green teletext
HA	Horizontal Acquisition: horizontal sync pulse coming out of the HIP
HD100	Horizontal Drive: horizontal sync pulse coming out of the featurebox
HDTV	High Definition TV: highest resolution defined by the ATSC standard (1080 lines and 1920 horizontal pixels, referred to as 1080i) The second HDTV standard, 720p x 1280 is not used in EM2E chassis (3fH standard not feasible)
Headroom	Extra margin provision to avoid clipping of signals
HEATER	Heater (Filament)
HFB	Horizontal Flyback Pulse: horizontal sync pulse from large signal deflection
HFB+13V	Non rectified output 13V-winding LOT
HIP	High-end video Input Processor: video and chroma decoder of EM2E
HOP	High-end video Output Processor: video, sync and geometry controller of EM2E
HP	Headphone
HSI	Hardware Software Interface

IN-FRONT-SNDL	Sound left front in
IN-FRONT-SNDR	Sound right front in
IN-SC1-B	In SCART1 Blue
IN-SC1-G	In SCART1 Green
IN-SC1-R	In SCART1 Red
IN-SC1-SNDL	In SCART1 sound left
IN-SC1-SNDR	In SCART1 sound right
IN-SC2-B	In SCART2 Blue
IN-SC2-CVBS_Y	In SCART2 CVBS or luminance (SVHS)
IN-SC2-FBL	In SCART2 fast blanking
IN-SC2-G	In SCART2 Green
Interlaced	Scan mode where two fields are used to form one frame. Each field contains half the number of the total amount of lines. The fields are written in “pairs”, causing line flicker.
IO-BUS	In/Out - Bus
Last Status	The settings last chosen by the customer and read and stored in RAM or in the NVM. They are called at start-up of the set to configure it according the customers wishes
LDP	Line Deflection Protection
LED	Light Emitting Diode
LINE-DRIVE	Line drive signal
LNA	Low Noise Adapter
LSP	Large signal panel
MSP	Multistandard Sound Processor: ITT sound decoder of EM2E
MUTE	Mute-Line
NC	Not Connected
NDF	No vertical DeFlection: vertical flyback protection
NHF	No Horizontal deflection: horizontal flyback protection
NVM	Non Volatile Memory: IC containing TV related data e.g. alignments
O/C	Open Circuit
ON/OFF LED	On/Off control signal for the LED
OSD	On Screen Display
OTC	On screen display Teletext and Control; also named Artistic (SAA5800)
P50	Project 50 communication: protocol between TV and peripherals
PCB	Printed Circuit board
PICNIC	Peripheral Integrated Combined Network IC: main IC for 100 Hz featuring and feature processing
PILOT	Pilot Signal
PILOTMUTE	Pilot Mute signal
Progressive Scan	Scan mode where all scan lines are displayed in one frame at the same time, creating a double vertical resolution.
PTP	Picture Tube Panel
RAM	Random Access Memory
RC	Remote Control
RC5	RC5 signal from the remote control receiver
RESET	Reset signal
ROM	Read Only Memory
SAM	Service Alignment Mode
SC	Sandcastle: pulse derived from sync signals
SCAVEM	Scan Velocity Modulation
S/C	Short Circuit
SC1-OUT	SCART output of the MSP audio IC
SC2-B-IN	Scart2 Blue in
SC2-C-IN	Scart2 chrominance in
SC2-OUT	SCART output of the MSP audio IC
SIF	Sound Intermediate Frequency
SIMM	80-fold connector between LSP and SSB
SLDP	Smart Local Dooming Prevention (HW and SW)
SNDL-SC1-IN	Sound left SCART1 in
SNDL-SC1-OUT	Sound left SCART1 out
SNDL-SC2-IN	Sound left SCART2 in
SNDL-SC2-OUT	Sound left SCART2 out
SNDR-SC1-IN	Sound right SCART1 in
SNDR-SC1-OUT	Sound right SCART1 out
SNDR-SC2-IN	Sound right SCART2 out
SNDR-SC2-OUT	Sound right SCART2 out
SNDS-VL-OUT	Surround sound left variable level out
SNDS-VR-OUT	Surround sound right variable level out
SNERT	Synchronous No parity Eight bit Reception and Transmit
SSB	Small Signal Board
STBY	Standby
SW	Subwoofer
TXT	Teletext
TXT DS	Teletext Dual Screen
µP	microprocessor
VA	Vertical Acquisition
V_{BAT}	main supply for deflection (mostly 141 V)
VD100	Vertical Drive: vertical sync pulse from deflection
VFB	Vertical Flyback Pulse: vertical sync pulse coming from the feature box
VL	Variable Level out: processed audio output towards external amplifier
WYSIWYR	What You See Is What You Record: record selection that follows main picture and sound
XTAL	Quartz crystal
Y-OUT	Luminance-signal to HOP IC

10. Spare parts list

Large Signal Panel [A]

Various

0010	2422 025 16374	2P Male
0020	4822 267 10774	2P Male
0032	4822 492 70788	IC-SPRING
0037	3104 304 21112	LOT SSB SUPPORT
0045	4822 267 10734	5P MALE
0065	3104 304 22031	LOT SPACER
0066	3104 304 21591	SCART SUPPORT BRACKET
0150	4822 265 11253	FUSE HOLDER
0153	4822 265 11253	FUSE HOLDER
0317	4822 265 20723	2P MALE
0324	3104 311 01881	CABLE 7P 480mm
0325	2422 025 16382	3P Male
0735	2422 025 16407	3P Male
0736	2422 025 16382	3P Male
0936	2422 025 12485	11P Male
0940	4822 267 10968	11P FEMALE
0943	4822 267 10748	3P MALE
0945	4822 267 10735	3P MALE
0946	5322 268 90415	2P MALE
0947	4822 267 10734	5P MALE
1001	4822 252 60151	SURGE PROTECT
1002	2422 132 07411	RELAY 1P 5V 5A
1003	4822 267 10973	1P
1200	4822 210 10848	UV1316/A I U-2
1205	2422 025 16599	80P Female SIMM
1501	4822 070 34002	FUSE 4A
1503	2422 086 10912	FUSE 2,5A
1901	4822 267 10771	IC SOCKET 42P
1902	4822 267 10982	2P
8000	4822 320 12525	CABLE
8001	4822 320 20234	EHT CABLE
8015	4822 320 20216	CABLE
	3122 785 100	Supply Kit Mains Supply EM2E
	3122 785 100	Supply Kit Standby Supply EM2E
	3122 785 100	Line Repair Kit EM2E

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2101	5322 122 32818	2.2nF 10% 100V
2102	4822 124 40248	10µF 20% 63V
2103	5322 122 32531	100pF 5% 50V
2104	4822 123 14025	2200µF 20% 16V
2105	5322 122 32531	100pF 5% 50V
2106	5322 126 10223	4.7nF 10% 63V
2107	5322 122 32818	2.2nF 10% 100V
2108	4822 121 70162	10nF 5% 400V
2109	4822 126 13482	470nF 80/20% 16V
2110	5322 121 42498	680nF 5% 63V
2111	4822 121 43526	47nF 5% 250V
2113	4822 122 33127	2.2nF 10% 63V
2114	4822 126 10206	2.2nF 10% 500V
2200	4822 124 40196	220µF 20% 16V
2201	4822 126 14076	220nF 25V
2202	4822 126 13473	220nF 80-20% 50V
2203	4822 124 41584	100µF 20% 10V
2400	4822 124 11575	47µF 20% 160V
2412	4822 126 13751	47nF 10% 63V
2413	4822 124 12255	10µF 20% 50V
2414	4822 126 13751	47nF 10% 63V
2415	4822 122 33575	220pF 5% 63V
2417	4822 126 14076	220nF 25V
2419	4822 126 14237	470pF 10% 2KV
2420	4822 121 70594	1nF 5% 2KV
2421	2022 333 00086	470nF 5% 250V
2421	4822 121 42634	560nF 5% 250V
2425	4822 121 10526	9N1 5% 2KV
2425	4822 121 70435	10nF 5% 2KV
2426	4822 121 10653	22nF 5% 630V
2426	4822 121 10658	24nF 5% 630V
2429	4822 121 43343	4.7nF 10% 400V
2430	4822 121 41857	10nF 5% 250V
2431	4822 121 42077	6.8nF 10% 400V
2431	4822 126 13599	3.3nF 10% 500V
2433	2022 333 00086	470nF 5% 250V
2433	4822 121 42634	560nF 5% 250V
2435	4822 121 10526	9N1 5% 2KV
2450	5322 121 42578	100nF 5% 250V
2455	5322 126 10511	1nF 5% 50V
2460	4822 124 40784	3300µF 20% 16V
2461	4822 122 31177	470pF 10% 500V
2462	4822 124 80061	1000µF 20% 25V
2463	4822 122 31177	470pF 10% 500V
2464	4822 124 80061	1000µF 20% 25V
2465	4822 122 31177	470pF 10% 500V
2468	4822 124 12297	4.7µF 20% 350V
2469	4822 122 31177	470pF 10% 500V
2480	4822 121 51442	2.2nF 10% 50V
2489	4822 124 40433	47µF 20% 25V
2490	4822 122 33891	3.3nF 10% 63V
2491	4822 124 40768	0.47µF 20% 100V
2492	4822 126 14076	220nF 25V
2495	4822 126 13838	100nF 20% 50V
2499	4822 126 13838	100nF 20% 50V
2501	4822 126 11524	1.5nF 10% 1KV
2502	5322 122 32818	2.2nF 10% 100V
2503	5322 121 42489	33nF 5% 250V
2505	4822 126 14504	3.3nF 20% 250V
2507	4822 126 13589	470nF 275V
2508	4822 126 14153	2.2nF 10%B 1KV
2509	4822 126 14153	2.2nF 10%B 1KV
2510	4822 124 12415	220µF 20% 400V
2512	4822 124 12056	1000µF 20% 35V
2513	5322 122 34099	470pF 10% 63V
2514	5322 122 31863	63V 330pF 5%
2515	4822 124 11575	47µF 20% 160V
2518	4822 126 11308	47pF 5% 500V
2519	5322 122 32818	2.2nF 10% 100V
2520	4822 126 14585	100nF 10% 50V
2521	4822 122 33216	270pF 5% 50V
2528	4822 126 14585	100nF 10% 50V
2530	4822 126 14585	100nF 10% 50V
2531	4822 122 31169	1.5nF 10% 500V
2535	4822 121 43913	470nF 10% 100V
2536	4822 126 10206	2.2nF 10% 500V
2537	4822 124 11913	22nF 20% 275V
2538	5322 126 10223	4.7nF 10% 63V
2600	4822 121 43913	470nF 10% 100V
2601	4822 121 51252	470nF 5% 63V
2602	4822 124 40433	47µF 20% 25V
2603	4822 122 33177	10nF 20% 50V
2604	4822 124 40248	10µF 20% 63V
2610	4822 122 33127	2.2nF 10% 63V
2620	4822 126 14076	220nF 25V
2621	4822 126 13838	100nF 20% 50V
2622	4822 124 40255	100µF 20% 63V
2624	4822 121 51252	470nF 5% 63V
2625	4822 121 51252	470nF 5% 63V
2627	5322 124 40641	10µF 20% 100V
2642	4822 124 40255	100µF 20% 63V
2700	4822 124 21913	1µF 20% 63V
2701	4822 124 21913	1µF 20% 63V
2730	4822 124 81151	22µF 50V
2731	4822 124 81151	22µF 50V
2732	4822 124 40255	100µF 20% 63V
2733	4822 124 40255	100µF 20% 63V
2734	4822 124 81151	22µF 50V
2735	4822 124 81151	22µF 50V
2736	5322 122 31865	1.5nF 10% 63V
2737	5322 122 31865	1.5nF 10% 63V
2756	4822 126 13751	47nF 10% 63V
2760	4822 124 80061	1000µF 20% 25V
2761	4822 124 80061	1000µF 20% 25V
2765	4822 124 40255	100µF 20% 63V
2767	4822 124 40255	100µF 20% 63V
2782	4822 126 13751	47nF 10% 63V
2902	5322 122 31863	330pF 5% 63V
2903	5322 122 31863	330pF 5% 63V
2906	5322 122 32531	100pF 5% 50V
2909	5322 122 31863	330pF 5% 63V
2910	5322 122 32531	100pF 5% 50V
2912	4822 124 40248	10µF 20% 63V
2913	4822 126 14585	100nF 10% 50V
2915	5322 122 31863	330pF 5% 63V
2916	5322 122 31863	330pF 5% 63V
2917	5322 122 32531	100pF 5% 50V
2919	5322 122 31863	330pF 5% 63V
2920	5322 122 32531	100pF 5% 50V
2923	5322 122 31863	330pF 5% 63V
2925	5322 122 31863	330pF 5% 63V
2926	4822 124 81044	470µF 20% 6.3V
2927	4822 124 40433	47µF 20% 25V
2941	5322 122 31865	1.5nF 10% 63V
2942	5322 122 31865	1.5nF 10% 63V
2951	4822 124 21913	1µF 20% 63V
2952	4822 126 13751	47nF 10% 63V
2953	4822 126 13751	47nF 10% 63V

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3101	4822 053 20106	10M 5% 0.25W
3102	4822 050 26801	680Ω 1% 0.6W
3103	4822 050 26801	680Ω 1% 0.6W
3104	4822 116 52195	47Ω 5% 0.5W
3105	4822 050 26801	680Ω 1% 0.6W
3106	4822 116 52256	2k2 5% 0.5W
3107	4822 116 52256	2k2 5% 0.5W
3108	4822 116 52182	15Ω 5% 0.5W
3110	4822 052 10109	10Ω 5% 0.33W
3113	4822 116 52182	15Ω 5% 0.5W
3114	4822 116 83872	220Ω 5% 0.5W
3117	4822 116 52195	47Ω 5% 0.5W
3118	4822 050 24708	4Ω7 1% 0.6W
3120	4822 051 20109	10Ω 5% 0.1W
3123	4822 116 52176	10Ω 5% 0.5W
3124	4822 116 52199	68Ω 5% 0.5W
3125	4822 116 52182	15Ω 5% 0.5W
3126	4822 050 21003	10k 1% 0.6W
3127	4822 116 52289	5k6 5% 0.5W
3200	4822 051 20101	100Ω 5% 0.1W
3201	4822 051 20101	100Ω 5% 0.1W
3250	4822 051 20223	22k 5% 0.1W
3402	4822 117 10837	100k 1% 0.1W
3403	4822 051 20101	100Ω 5% 0.1W
3404	4822 051 20471	470Ω 5% 0.1W
3406	4822 051 20101	100Ω 5% 0.1W
3407	4822 117 10833	10k 1% 0.1W
3410	4822 051 20479	47Ω 5% 0.1W
3411	4822 116 52193	39Ω 5% 0.5W
3414	4822 117 13577	330Ω 1% 1.25W
3415	3198 012 31590	15Ω 5% 3W
3415	4822 117 12836	12Ω 5% 3W
3417	4822 116 52176	10Ω 5% 0.5W
3418	4822 050 22704	270k 1% 0.6W
3431	4822 052 10101	100Ω 5% 0.33W
3431	4822 052 10221	220Ω 5% 0.33W
3450	4822 116 52303	8k2 5% 0.5W
3450	4822 116 83961	6k8 5%
3451	4822 116 52257	22k 5% 0.5W
3460	4822 052 10108	1Ω 5% 0.33W
3461	4822 052 10108	1Ω 5% 0.33W
3462	4822 052 10108	1Ω 5% 0.33W
3463	4822 052 10108	1Ω 5% 0.33W
3464	4822 052 10108	1Ω 5% 0.33W
3465	4822 052 10108	1Ω 5% 0.33W
3466	4822 052 10688	6Ω8 5% 0.33W
3466	4822 052 10828	8Ω2 5% 0.33W
3467	4822 052 10108	1Ω 5% 0.33W
3468	4822 052 11688	6Ω8 5% 0.5W
3475	4822 116 52175	100Ω 5% 0.5W
3481	4822 116 52175	100Ω 5% 0.5W
3483	4822 051 10102	1k 2% 0.25W
3484	4822 117 11139	1k5 1% 0.1W
3485	4822 117 11454	820Ω 1% 0.1W
3486	4822 117 12955	2k7 1% 0.1W
3487	4822 117 11449	2k2 1% 0.1W
3488	4822 116 52272	330k 5% 0.5W
3488	4822 116 83874	220k 5% 0.5W
3489	4822 117 11449	2k2 1% 0.1W
3491	4822 050 21504	150k 1% 0.6W
3495	4822 051 20683	68k 5% 0.1W
3496	4822 117 11507	6k8 1% 0.1W
3497	4822 117 10834	47k 1% 0.1W
3498	4822 051 20472	4k7 5% 0.1W
3499	4822 117 10837	100k 1% 0.1W
3500	4822 117 12074	1Ω5 10% 7W
3501	3198 013 04710	470Ω 2% 1/2W
3504	4822 116 83883	470Ω 5% 0.5W
3507	4822 050 21604	160k 1% 0.6W
3508	3198 012 16820	6.8k 1W
3509	2322 595 90021	VDR DC 1M A/495V
3510	4822 117 11951	2k 1% 0.1W
3511	4822 116 52276	3k9 5% 0.5W
3512	4822 116 52297	68k 5% 0.5W
3513	4822 116 52272	330k 5% 0.5W
3514	4822 053 10108	1Ω 5% 1W
3515	4822 053 10108	1Ω 5% 1W
3516	4822 116 10075	9Ω 220V
3518	4822 050 11204	120k 1% 0.4W
3519	4822 051 20223	22k 5% 0.1W
3520	4822 053 11333	33k 5% 2W

3521	4822 117 10118	1M 5% 0.5W
3522	4822 116 83961	6k8 5%
3523	4822 051 20105	1M 5% 0.1W
3524	4822 051 10102	1k 2% 0.25W
3525	4822 051 20479	47Ω 5% 0.1W
3526	4822 116 83303	1Ω 2W
3527	4822 117 11454	820Ω 1% 0.1W
3528	4822 117 10833	10k 1% 0.1W
3529	4822 051 20472	4k7 5% 0.1W
3530	4822 116 52297	68k 5% 0.5W
3531	4822 117 10833	10k 1% 0.1W
3533	4822 051 20159	15Ω 5% 0.1W
3535	4822 051 20273	27k 5% 0.1W
3536	4822 117 10837	100k 1% 0.1W
3537	4822 117 10833	10k 1% 0.1W
3538	4822 051 20332	3k3 5% 0.1W
3539	4822 117 10833	10k 1% 0.1W
3540	4822 117 10834	47k 1% 0.1W
3541	4822 117 10833	10k 1% 0.1W
3542	3198 012 11570	0Ω15 5% 1W
3543	4822 051 20478	4Ω7 5% 0.1W
3544	4822 051 20479	47Ω 5% 0.1W
3600	4822 050 22205	2M2 1% 0.6W
3601	4822 050 22205	2M2 1% 0.6W
3602	4822 051 20332	3k3 5% 0.1W
3603	4822 101 11319	100Ω LIN
3605	4822 051 20273	27k 5% 0.1W
3606	4822 051 10102	1k 2% 0.25W
3607	4822 051 20223	22k 5% 0.1W
3608	4822 051 20223	22k 5% 0.1W
3609	4822 101 11193	47k 30% LIN 0.1W
3610	4822 051 20683	68k 5% 0.1W
3611	4822 051 20822	8k2 5% 0.1W
3612	4822 051 20274	270k 5% 0.1W
3613	4822 051 20274	270k 5% 0.1W
3614	4822 050 21005	1M 1% 0.6W
3615	4822 050 18204	820k 1% 0.4W
3615	4822 116 52292	560k 5% 0.5W
3616	4822 116 52285	470k 5% 0.5W
3617	4822 050 11002	1k 1% 0.4W
3618	4822 051 10102	1k 2% 0.25W
3619	4822 051 20562	5k6 5% 0.1W
3620	4822 116 80176	1Ω 5% 0.5W
3620	4822 116 80676	1Ω5 5% 0.5W
3621	4822 116 80176	1Ω 5% 0.5W
3622	4822 116 80176	1Ω 5% 0.5W
3623	4822 117 10834	47k 1% 0.1W
3624	4822 052 10158	1Ω5 5% 0.33W
3625	4822 116 83872	220Ω 5% 0.5W
3626	4822 116 83872	220Ω 5% 0.5W
3627	4822 050 21003	10k 1% 0.6W
3630	4822 051 10102	1k 2% 0.25W
3631	4822 051 20332	3k3 5% 0.1W
3632	4822 117 10833	10k 1% 0.1W
3633	4822 050 21003	10k 1% 0.6W
3644	4822 117 10833	10k 1% 0.1W
3645	4822 116 52245	150k 5% 0.5W
3652	4822 051 20101	100Ω 5% 0.1W
3701	4822 117 10833	10k 1% 0.1W
3702	4822 117 10833	10k 1% 0.1W
3730	4822 117 10833	10k 1% 0.1W
3731	4822 117 10833	10k 1% 0.1W
3732	4822 051 20822	8k2 5% 0.1W
3733	4822 051 20822	8k2 5% 0.1W
3734	4822 117 10834	47k 1% 0.1W
3735	4822 117 10834	47k 1% 0.1W
3736	4822 051 10102	1k 2% 0.25W
3737	4822 051 10102	1k 2% 0.25W
3738	4822 117 11148	56k 1% 0.1W
3739	4822 117 11148	56k 1% 0.1W
3740	4822 051 20683	68k 5% 0.1W
3741	4822 051 20683	68k 5% 0.1W
3742	4822 116 52199	68Ω 5% 0.5W
3743	4822 116 52199	68Ω 5% 0.5W
3756	4822 117 10833	10k 1% 0.1W
3762	4822 051 20828	8Ω2 5% 0.1W
3765	4822 117 11507	6k8 1% 0.1W
3770	4822 117 10834	47k 1% 0.1W
3771	4822 116 83933	15k 1% 0.1W
3773	4822 116 83933	15k 1% 0.1W
3789	4822 051 20828	8Ω2 5% 0.1W
3790	4822 051 10102	1k 2% 0.25W
3792	4822 051 10102	1k 2% 0.25W
3900	4822 116 83868	150Ω 5% 0.5W
3901	4822 117 10353	150Ω 1% 0.1W
3902	4822 117 10353	150Ω 1% 0.1W
3903	4822 117 10353	150Ω 1% 0.1W
3905	4822 116 83883	470Ω 5% 0.5W
3906	4822 116 52201	75Ω 5% 0.5W
3907	4822 051 20561	560Ω 5% 0.1W
3908	4822 116 52201	75Ω 5% 0.5W
3909	4822 116 52201	75Ω 5% 0.5W
3910	4822 116 52201	75Ω 5% 0.5W
3911	4822 116 52201	75Ω 5% 0.5W
3913	4822 116 52201	75Ω 5% 0.5W
3915	4822 116 52201	75Ω 5% 0.5W
3916	4822 051 20822	8k2 5% 0.1W
3918	4822 051 20392	3k9 5% 0.1W
3919	4822 051 10102	1k 2% 0.25W
3920	4822 051 10102	1k 2% 0.25W
3921	4822 117 10353	150Ω 1% 0.1W
3922	4822 117 10353	150Ω 1% 0.1W
3923	4822 117 10353	150Ω 1% 0.1W
3924	4822 117 10353	150Ω 1% 0.1W
3925	4822 052 10688	6Ω8 5% 0.33W
3928	4822 051 20101	100Ω 5% 0.1W
3929	4822 117 10833	10k 1% 0.1W
3930	4822 051 20561	560Ω 5% 0.1W
3932	4822 116 52201	75Ω 5% 0.5W
3935	4822 116 52201	75Ω 5% 0.5W
3936	4822 117 10353	150Ω 1% 0.1W
3937	4822 117 10353	150Ω 1% 0.1W
3940	4822 117 10353	150Ω 1% 0.1W
3941	4822 117 10353	150Ω 1% 0.1W
3942	4822 051 20822	8k2 5% 0.1W
3944	4822 051 10102	1k 2% 0.25W
3945	4822 051 20392	3k9 5% 0.1W
3946	4822 051 10102	1k 2% 0.25W
3970	4822 051 20471	470Ω 5% 0.1W
3971	4822 117 10833	10k 1% 0.1W
3972	4822 117 10833	10k 1% 0.1W
3991	4822 116 52175	100Ω 5% 0.5W
3992	4822 051 20101	100Ω 5% 0.1W
3993	4822 051 20101	100Ω 5% 0.1W
3994	4822 116 52175	100Ω 5% 0.5W
3995	4822 116 52175	100Ω 5% 0.5W
3996	4822 116 52175	100Ω 5% 0.5W
3997	4822 116 52175	100Ω 5% 0.5W
3998	4822 116 52175	100Ω 5% 0.5W
4xxx	4822 051 10008	0Ω 5% 0.25W
4xxx	4822 051 20008	0Ω 5% 0.25W
9220	4822 051 20008	JUMPER
9225	4822 051 20008	JUMPER
9723	4822 051 20008	JUMPER
9724	4822 051 20008	JUMPER

5101	4822 146 11065	STANDBY TFM
5102	4822 157 70436	8.2µH
5103	4822 526 10704	BEAD 50MHz
5104	4822 157 11411	BEAD 100MHz
5105	4822 526 10704	BEAD 100MHz
5200	4822 157 11775	6.8µH 5%
5400	4822 157 11869	33µH 10%
5410	4822 146 11065	TFM SIG FIX
5411	4822 157 71097	0.56µH
5421	4822 157 11204	COIL LINE CORR.(29")
5421	4822 157 11839	COIL LINE CORR. (28")
5421	4822 157 11841	COIL LINE CORR. (28"WS,32"WS)
5422	4822 157 71535	COIL BRIDGE
5424	4822 157 63255	COIL BRIDGE
5430	8204 000 73321	LOT (29")
5430	8228 001 33243	LOT (25",28")
5461	4822 157 11411	BEAD 100MHz
5463	4822 157 11411	BEAD 100MHz
5465	4822 157 11411	BEAD 100MHz
5466	4822 157 71467	39U 10%
5467	4822 157 11411	BEAD 100MHz
5504	2422 549 43286	MAINS 35mH 1A5
5505	4822 157 11411	BEAD 100MHz
5506	2422 531 98042	TFM W8085-002 Y
5510	4822 157 11411	BEAD 100MHz
5620	4822 157 11771	0.09µH 10%

6103	4822 130 42488	BYD33D
6105	4822 130 34281	BZX79-B15
6106	4822 130 34499	BZX79-B20
6108	4822 130 30621	1N4148
6109	4822 130 31083	BYW55
6111	4822 130 32715	SB340
6120	4822 130 30621	1N4148
6121	4822 130 30621	1N4148
6122	3198 010 53980	BZX79-B3V9
6200	9322 149 10685	BZM55-C33
6201	4822 130 83757	BAS216
6202	4822 130 83757	BAS216
6203	4822 130 10852	BZX284-C6V8
6204	4822 130 10852	BZX284-C6V8
6205	4822 130 83757	BAS216
6405	4822 130 11027	BZX284-C33
6406	4822 130 83757	BAS216
6407	4822 130 83757	BAS216
6408	4822 130 42488	BYD33D
6421	4822 130 10753	BY359X-1500
6422	4822 130 10218	BY229X-800
6442	9322 129 42685	BZM55-C15
6461	4822 130 82512	BYV29F-400
6462	4822 130 41487	BYV95C
6464	5322 130 31938	BYV27-200
6468	4822 130 42488	BYD33D
6480	4822 130 42488	BYD33D
6481	4822 130 31024	BZX79-B18
6482	4822 130 83757	BAS216
6499	4822 130 83757	BAS216
6501	4822 130 31083	BYW55
6502	4822 130 31083	BYW55
6503	4822 130 31083	BYW55
6504	4822 130 31083	BYW55
6505	4822 130 34281	BZX79-B15
6506	4822 130 30621	1N4148
6507	4822 130 80791	BYV28-200/20
6508	4822 130 11415	BYV28-400/20
6510	4822 130 34281	BZX79-B15
6511	4822 130 83757	BAS216
6512	4822 130 83757	BAS216
6514	5322 130 31932	BZT03-C200
6515	4822 130 32904	BZV85-C5V6
6516	4822 130 83757	BAS216
6517	4822 130 31983	BAT85
6518	4822 130 83757	BAS216
6520	4822 130 42488	BYD33D
6521	4822 130 83757	BAS216
6522	4822 130 83757	BAS216
6600	4822 130 31983	BAT85
6616	4822 130 83757	BAS216
6619	4822 130 42488	BYD33D
6620	5322 130 31938	BYV27-200
6621	4822 130 42488	BYD33D
6622	5322 130 33635	BZV85-C8V2
6623	4822 130 83757	BAS216

7100	4822 130 44568	BC557B
7101	4822 130 40959	BC547B
7102	4822 130 11417	STP3NB60FP
7104	4822 130 11418	TCDT1102G
7407	4822 130 60511	BC847B
7408	9332 592 40126	BC368
7409	4822 130 60511	BC847B
7421	4822 130 63666	BU2520DF
7480	4822 130 11417	STP3NB60FP
7481	4822 130 44568	BC557B
7482	4822 130 11418	TCDT1102G
7499	4822 130 60373	BC856B
7502	4822 130 61675	BF487
7504	9322 126 65687	STP5NB60FP
7505	4822 130 60373	BC856B
7506	4822 209 81397	TL431CLPST
7510	4822 130 60511	BC847B
7511	4822 130 60373	BC856B
7528	4822 130 40981	BC337-25
7529	4822 130 60511	BC847B
7600	4822 130 44461	BC546B
7602	4822 130 60511	BC847B
7603	4822 130 60373	BC856B
7605	4822 130 60511	BC847B
7606	4822 130 60511	BC847B
7610	4822 130 11418	TCDT1102G
7620	4822 209 90009	TDA8177
7641	4822 130 60511	BC847B
7652	4822 130 60511	BC847B
7720	4822 130 60511	BC847B
7721	4822 130 60511	BC847B
7722	4822 130 60373	BC856B
7723	4822 130 60373	BC856B
7724	4822 130 60511	BC847B
7725	4822 130 60511	BC847B
7730	4822 130 60511	BC847B
7750	4822 209 32269	TDA2616/N1
7900	4822 130 40959	BC547B
7901	4822 130 40959	BC547B
7905	9332 592 40126	BC368
7906	4822 209 12334	L4940V85
7907	4822 130 60511	BC847B

Small Signal Panel [B]

Various

1001	2422 543 89022	RES XTL 6M000
1301	2422 540 98456	RES 12MHz
1305	2422 543 01092	RES XTL 4M433619
1308	2422 543 01097	RES XTL 3M579545
1405	2422 549 44369	FIL SAW 38MHz
1407	2422 549 44324	FIL TPWCC04BS
1408	2422 549 44372	FIL SAW 38MHz
1409	2422 025 16542	2P MALE
1651	2422 543 89019	RES XTL 8M432
1701	2422 543 89018	RES XTL 12MHz

⊣⊢

2001	4822 126 11671	33pF
2002	4822 126 11669	27pF
2003	4822 126 13879	220nF 20% 16V
2004	4822 126 13879	220nF 20% 16V
2005	4822 126 14305	100nF 10% 16V
2006	4822 126 14305	100nF 10% 16V
2007	4822 126 14305	100nF 10% 16V
2008	4822 126 14305	100nF 10% 16V
2009	4822 122 33777	47pF 5% 63V
2010	4822 122 33777	47pF 5% 63V
2011	4822 122 33777	47pF 5% 63V
2012	4822 122 33777	47pF 5% 63V
2013	4822 124 12095	100µF 20% 16V
2014	4822 126 14305	100nF 10% 16V
2015	4822 126 14305	100nF 10% 16V
2016	4822 124 12095	100µF 20% 16V
2017	4822 126 14305	100nF 10% 16V
2019	4822 126 14305	100nF 10% 16V
2020	4822 126 13883	220pF 5% 50V
2022	4822 126 14305	100nF 10% 16V
2023	4822 126 14305	100nF 10% 16V
2024	4822 126 14305	100nF 10% 16V
2025	4822 126 14305	100nF 10% 16V
2026	4822 126 14305	100nF 10% 16V
2027	4822 126 14305	100nF 10% 16V
2028	4822 126 14305	100nF 10% 16V
2029	4822 126 14305	100nF 10% 16V
2031	4822 126 14305	100nF 10% 16V
2032	4822 126 14305	100nF 10% 16V
2033	4822 126 14226	82pF 5% 50V
2034	4822 126 14226	82pF 5% 50V
2035	4822 126 14226	82pF 5% 50V
2036	4822 126 14226	82pF 5% 50V
2037	4822 126 14226	82pF 5% 50V
2038	4822 126 14305	100nF 10% 16V
2300	4822 124 12095	100µF 20% 16V
2303	5322 126 11583	10nF 10% 50V
2304	4822 122 33741	10pF 10% 50V
2306	4822 126 13881	470pF 5% 50V
2307	4822 126 14305	100nF 10% 16V
2308	4822 122 33741	10pF 10% 50V
2313	4822 121 70159	0.1µF 16V
2314	4822 124 12095	100µF 20% 16V
2315	4822 126 14305	100nF 10% 16V
2317	4822 126 14491	2.2µF 10V
2318	4822 126 14494	22nF 10% 25V
2319	5322 126 11583	10nF 10% 50V
2320	4822 122 33741	10pF 10% 50V
2321	4822 126 14305	100nF 10% 16V
2322	4822 126 14305	100nF 10% 16V
2323	4822 126 14305	100nF 10% 16V
2324	5322 126 11583	10nF 10% 50V
2325	4822 126 14305	100nF 10% 16V
2328	4822 122 33761	22pF 5% 50V
2329	4822 126 14305	100nF 10% 16V
2330	4822 126 14305	100nF 10% 16V
2331	4822 126 14305	100nF 10% 16V
2332	4822 126 14305	100nF 10% 16V
2333	4822 126 14491	2.2µF 10V
2334	4822 126 14491	2.2µF 10V
2335	4822 124 80349	47µF 20% 6.3V
2336	4822 126 14491	2.2µF 10V
2338	5322 126 11583	10nF 10% 50V
2340	4822 124 23002	10µF 16V
2341	4822 124 12095	100µF 20% 16V
2350	4822 126 14305	100nF 10% 16V
2351	4822 126 14305	100nF 10% 16V
2352	4822 126 14305	100nF 10% 16V
2356	4822 126 14305	100nF 10% 16V
2357	4822 126 14305	100nF 10% 16V
2358	5322 126 11579	3.3nF 10% 63V
2359	4822 122 33752	15pF 5% 50V
2361	3198 016 31580	1P5 50V
2362	4822 126 11663	12pF
2365	4822 126 14305	100nF 10% 16V
2366	4822 126 14305	100nF 10% 16V
2367	4822 126 14305	100nF 10% 16V
2368	4822 126 14305	100nF 10% 16V
2369	4822 126 14305	100nF 10% 16V
2370	4822 126 14305	100nF 10% 16V
2371	4822 126 13193	4.7nF 10% 63V
2372	4822 126 14043	1µF 20% 16V
2373	4822 126 14305	100nF 10% 16V
2374	4822 126 14491	2.2µF 10V
2375	4822 126 14494	22nF 10% 25V
2376	4822 126 14305	100nF 10% 16V
2377	4822 124 12095	100µF 20% 16V
2378	4822 126 14305	100nF 10% 16V
2384	4822 126 14305	100nF 10% 16V
2406	4822 126 13883	220pF 5% 50V
2407	4822 126 13956	68pF 5% 63V
2408	3198 016 32780	2P7 50V
2409	4822 126 14491	2.2µF 10V
2410	4822 126 14472	1µF 10% 10V
2411	4822 126 14305	100nF 10% 16V
2412	4822 126 13193	4.7nF 10% 63V
2413	4822 124 80151	47µF 16V
2417	3198 017 44740	470nF 10V
2418	4822 126 13956	68pF 5% 63V
2420	4822 122 33753	150pF 5% 50V
2501	4822 122 33777	47pF 5% 63V
2502	4822 122 32927	220nF 20% 50V
2503	4822 122 32927	220nF 20% 50V
2504	4822 122 32927	220nF 20% 50V
2505	4822 122 32927	220nF 20% 50V
2508	4822 124 12095	100µF 20% 16V
2546	4822 124 23002	10µF 16V
2547	4822 124 23002	10µF 16V
2548	4822 124 23002	10µF 16V
2549	4822 124 23002	10µF 16V
2550	4822 126 14241	330P 50V
2551	5322 126 11579	3.3nF 10% 63V
2609	3198 016 31020	0603 25V 1nF
2610	4822 126 14238	2N2 50V
2611	5322 126 11578	1nF 10% 50V
2629	4822 122 32927	220nF 20% 50V
2636	4822 122 32927	220nF 20% 50V
2637	4822 122 32927	220nF 20% 50V
2638	4822 122 32927	220nF 20% 50V
2640	4822 126 13879	220nF 20% 16V
2641	4822 122 32927	220nF 20% 50V
2642	4822 122 32927	220nF 20% 50V
2651	4822 126 14305	100nF 10% 16V
2652	4822 122 33777	47pF 5% 63V
2653	4822 122 32927	220nF 20% 50V
2654	4822 126 13881	470pF 5% 50V
2655	4822 126 13881	470pF 5% 50V
2656	4822 126 13881	470pF 5% 50V
2657	4822 126 13881	470pF 5% 50V
2658	4822 126 13881	470pF 5% 50V
2661	4822 122 32927	220nF 20% 50V
2662	4822 122 32927	220nF 20% 50V
2663	4822 126 13881	470pF 5% 50V
2664	4822 126 13881	470pF 5% 50V
2665	4822 124 12095	100µF 20% 16V
2666	4822 124 12095	100µF 20% 16V
2667	3198 016 33380	3P3 50V
2668	3198 016 33380	3P3 50V
2669	4822 124 23002	10µF 16V
2670	5322 126 11583	10nF 10% 50V
2673	3198 016 31020	1nF 25V
2674	3198 016 31020	1nF 25V
2675	4822 124 23002	10µF 16V
2677	3198 030 82280	2U2 20% 50V
2677	4822 124 23002	10µF 16V
2678	4822 124 23002	10µF 16V
2679	4822 126 14305	100nF 10% 16V
2680	4822 124 23002	10µF 16V
2681	4822 126 14305	100nF 10% 16V
2682	4822 124 23002	10µF 16V
2685	3198 016 31020	1nF 25V
2686	3198 016 31020	1nF 25V
2690	4822 126 14305	100nF 10% 16V
2691	4822 126 14305	100nF 10% 16V
2692	4822 126 14305	100nF 10% 16V
2693	4822 126 13883	220pF 5% 50V
2702	4822 124 23002	10µF 16V
2703	4822 126 14305	100nF 10% 16V
2704	4822 124 23002	10µF 16V
2706	4822 124 12095	100µF 20% 16V
2707	4822 126 14305	100nF 10% 16V
2708	4822 124 23002	10µF 16V
2709	4822 126 14305	100nF 10% 16V
2710	4822 124 23002	10µF 16V
2712	4822 124 23002	10µF 16V
2713	4822 126 14305	100nF 10% 16V
2717	4822 126 14218	3.9pF 50V
2718	4822 126 11669	27pF
2719	4822 126 11663	12pF
2720	4822 126 14218	3.9pF 50V
2721	4822 126 11669	27pF
2723	4822 126 11663	12pF
2724	4822 126 14218	3.9pF 50V
2725	4822 126 11669	27pF
2726	4822 126 11663	12pF
2728	4822 126 14305	100nF 10% 16V
2729	4822 126 14225	56pF 5% 50V
2730	4822 126 14494	22nF 10% 25V
2731	4822 122 31765	100pF 2% 63V
2733	4822 126 14494	22nF 10% 25V
2738	4822 126 14494	22nF 10% 25V
2743	4822 126 14494	22nF 10% 25V
2747	4822 126 14507	18pF 5% 50V
2748	4822 126 14507	18pF 5% 50V
2755	4822 126 14305	100nF 10% 16V
2756	4822 126 14305	100nF 10% 16V
2757	4822 124 23002	10µF 16V
2758	4822 126 14305	100nF 10% 16V
2759	4822 126 14305	100nF 10% 16V
2760	4822 126 14305	100nF 10% 16V
2761	4822 126 14305	100nF 10% 16V
2762	4822 126 14305	100nF 10% 16V
2763	4822 126 14305	100nF 10% 16V
2764	4822 126 14305	100nF 10% 16V
2765	4822 126 14305	100nF 10% 16V
2766	4822 126 14305	100nF 10% 16V
2767	4822 126 14305	100nF 10% 16V
2770	4822 126 14305	100nF 10% 16V
2771	4822 126 14305	100nF 10% 16V
2772	4822 126 14305	100nF 10% 16V
2773	4822 126 14305	100nF 10% 16V
2774	4822 126 14305	100nF 10% 16V
2776	4822 126 14305	100nF 10% 16V
2785	4822 126 14305	100nF 10% 16V
2786	4822 126 14305	100nF 10% 16V
2788	4822 126 14305	100nF 10% 16V
2790	4822 126 14305	100nF 10% 16V
2792	4822 126 14305	100nF 10% 16V
2795	4822 126 14305	100nF 10% 16V
2796	4822 126 14305	100nF 10% 16V
2797	4822 126 13956	68pF 5% 63V
2798	3198 016 36810	680P 25V
2902	5322 126 11583	10nF 10% 50V

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3001	4822 051 30472	4k7 5% 0.062W
3002	4822 051 30472	4k7 5% 0.062W
3003	4822 051 30223	22k 5% 0.062W
3006	4822 051 30471	470Ω 5% 0.062W
3007	4822 117 13521	470Ω 5% 0.63W
3008	4822 117 13526	150Ω 5% 0.63W
3009	4822 051 30689	68Ω 5% 0.063W
3011	4822 051 30471	470Ω 5% 0.062W
3012	4822 051 30471	470Ω 5% 0.062W
3013	4822 051 30103	10k 5% 0.062W
3014	4822 051 30682	6k8 5% 0.062W
3015	4822 051 30474	470k 5% 0.062W
3016	4822 051 30152	1k5 5% 0.062W
3017	4822 051 30472	4k7 5% 0.062W
3018	4822 051 30103	10k 5% 0.062W
3019	4822 051 30472	4k7 5% 0.062W
3020	4822 051 30103	10k 5% 0.062W
3021	4822 051 30103	10k 5% 0.062W
3023	4822 051 30471	470Ω 5% 0.062W
3024	4822 051 30273	27k 5% 0.062W
3025	4822 051 30221	220Ω 5% 0.062W
3026	4822 051 30103	10k 5% 0.062W
3027	4822 117 12925	47k 1% 0.063W
3028	4822 051 30471	470Ω 5% 0.062W
3029	4822 051 30103	10k 5% 0.062W
3030	4822 051 30103	10k 5% 0.062W
3031	4822 051 30103	10k 5% 0.062W
3032	4822 051 30471	470Ω 5% 0.062W
3033	4822 051 30103	10k 5% 0.062W
3034	4822 051 30101	100Ω 5% 0.062W
3035	4822 117 13522	100Ω 5% 0.63W
3039	4822 051 30101	100Ω 5% 0.062W
3040	4822 051 30103	10k 5% 0.062W
3041	4822 051 30562	5k6 5% 0.063W
3044	2120 108 92846	4k7 5%
3058	4822 051 30682	6k8 5% 0.062W

3059	2322 704 66201	620Ω 1%
3060	4822 051 30103	10k 5% 0.062W
3061	4822 051 30103	10k 5% 0.062W
3062	4822 051 30103	10k 5% 0.062W
3064	4822 117 13522	100Ω 5% 0.63W
3073	4822 051 30471	470Ω 5% 0.062W
3074	4822 051 30471	470Ω 5% 0.062W
3075	4822 051 30103	10k 5% 0.062W
3076	4822 051 30471	470Ω 5% 0.062W
3077	4822 051 30272	2k7 5% 0.062W
3078	4822 051 30471	470Ω 5% 0.062W
3079	4822 051 30471	470Ω 5% 0.062W
3080	4822 051 30103	10k 5% 0.062W
3081	4822 051 30471	470Ω 5% 0.062W
3083	4822 051 30471	470Ω 5% 0.062W
3084	4822 051 30103	10k 5% 0.062W
3085	4822 051 30471	470Ω 5% 0.062W
3086	4822 051 30471	470Ω 5% 0.062W
3087	4822 051 30471	470Ω 5% 0.062W
3088	4822 051 30471	470Ω 5% 0.062W
3090	4822 051 30471	470Ω 5% 0.062W
3091	4822 051 30471	470Ω 5% 0.062W
3092	4822 051 30221	220Ω 5% 0.062W
3300	2322 750 63908	3Ω9 5%
3304	2322 750 63908	3Ω9 5%
3306	4822 051 30221	220Ω 5% 0.062W
3307	4822 051 30183	18k 5% 0.062W
3308	4822 051 30684	680k 5% 0.062W
3310	4822 117 12925	47k 1% 0.063W
3311	4822 117 13632	100k 1% 0.62W
3314	4822 051 30103	10k 5% 0.062W
3315	4822 051 30102	1k 5% 0.062W
3316	4822 051 30123	12k 5% 0.062W
3317	4822 051 30221	220Ω 5% 0.062W
3318	4822 051 30102	1k 5% 0.062W
3320	4822 051 30101	100Ω 5% 0.062W
3321	4822 051 30101	100Ω 5% 0.062W
3322	4822 051 10102	1k 2% 0.25W
3324	4822 051 30222	2k2 5% 0.062W
3327	4822 117 13632	100k 1% 0.62W
3328	4822 051 30393	39k 5% 0.062W
3329	4822 117 13568	6Ω8 5%
3330	4822 051 30332	3k3 5% 0.062W
3331	4822 051 30102	1k 5% 0.062W
3333	4822 051 30102	1k 5% 0.062W
3334	4822 051 30102	1k 5% 0.062W
3335	4822 051 30332	3k3 5% 0.062W
3336	4822 051 30102	1k 5% 0.062W
3337	4822 117 12903	1k8 1% 0.063W
3338	4822 051 30682	6k8 5% 0.062W
3340	4822 051 30101	100Ω 5% 0.062W
3341	4822 051 30101	100Ω 5% 0.062W
3342	4822 051 30101	100Ω 5% 0.062W
3343	4822 051 30683	68k 5% 0.062W
3344	4822 051 30222	2k2 5% 0.062W
3345	4822 051 30103	10k 5% 0.062W
3346	4822 051 30333	33k 5% 0.062W
3347	4822 051 30223	22k 5% 0.062W
3348	4822 051 30222	2k2 5% 0.062W
3362	4822 051 30103	10k 5% 0.062W
3363	4822 051 30102	1k 5% 0.062W
3364	4822 051 30683	68k 5% 0.062W
3365	4822 051 30472	4k7 5% 0.062W
3366	4822 051 30102	1k 5% 0.062W
3367	4822 051 30102	1k 5% 0.062W
3370	4822 051 30101	100Ω 5% 0.062W
3371	4822 051 30479	47Ω 5% 0.062W
3372	4822 051 30471	470Ω 5% 0.062W
3376	4822 051 30101	100Ω 5% 0.062W
3377	4822 051 30101	100Ω 5% 0.062W
3378	4822 051 30153	15k 5% 0.062W
3382	4822 051 30471	470Ω 5% 0.062W
3384	4822 051 30101	100Ω 5% 0.062W
3385	4822 051 30471	470Ω 5% 0.062W
3386	4822 051 30223	22k 5% 0.062W
3388	4822 051 30102	1k 5% 0.062W
3389	4822 117 12925	47k 1% 0.063W
3390	4822 051 30153	15k 5% 0.062W
3391	4822 051 30683	68k 5% 0.062W
3393	4822 117 13632	100k 1% 0.62W
3394	4822 051 30472	4k7 5% 0.062W
3400	4822 117 11152	4Ω7 5%
3406	4822 051 30479	47Ω 5% 0.062W
3411	4822 051 30472	4k7 5% 0.062W
3414	4822 051 30472	4k7 5% 0.062W
3415	4822 117 12902	8k2 1% 0.063W
3416	4822 117 13568	6Ω8 5%
3418	4822 051 30391	390Ω 5% 0.062W
3419	4822 051 30759	75Ω 5% 0.062W
3435	4822 051 30472	4k7 5% 0.062W
3436	4822 051 30221	220Ω 5% 0.062W
3437	4822 051 30102	1k 5% 0.062W
3439	4822 051 30471	470Ω 5% 0.062W
3441	4822 051 30393	39k 5% 0.062W
3445	4822 051 30471	470Ω 5% 0.062W
3446	4822 051 30101	100Ω 5% 0.062W
3532	4822 051 30102	1k 5% 0.062W
3533	4822 051 30103	10k 5% 0.062W
3540	4822 051 30103	10k 5% 0.062W
3550	4822 051 30102	1k 5% 0.062W
3551	4822 051 30102	1k 5% 0.062W
3552	4822 051 30472	4k7 5% 0.062W
3610	4822 117 12925	47k 1% 0.063W
3611	4822 117 12925	47k 1% 0.063W
3612	4822 117 12925	47k 1% 0.063W
3613	4822 117 12925	47k 1% 0.063W
3614	4822 117 12925	47k 1% 0.063W
3615	4822 117 12925	47k 1% 0.063W
3616	4822 051 30682	6k8 5% 0.062W
3617	4822 051 30682	6k8 5% 0.062W
3621	4822 051 30105	1M 5% 0.062W
3636	4822 051 30105	1M 5% 0.062W
3637	4822 051 30105	1M 5% 0.062W
3638	4822 051 30105	1M 5% 0.062W
3642	4822 051 30105	1M 5% 0.062W
3644	4822 051 30105	1M 5% 0.062W
3653	3198 021 90030	JUMPER
3654	3198 021 90030	JUMPER
3655	4822 051 30101	100Ω 5% 0.062W
3656	4822 051 30101	100Ω 5% 0.062W
3657	4822 051 30334	330k 5% 0.062W
3658	4822 051 30334	330k 5% 0.062W
3659	4822 051 30334	330k 5% 0.062W
3660	4822 051 30334	330k 5% 0.062W
3661	4822 117 11817	1k2 1% 1/16W
3662	4822 117 11817	1k2 1% 1/16W
3663	4822 117 11817	1k2 1% 1/16W
3665	4822 051 30272	2k7 5% 0.062W
3673	4822 051 30472	4k7 5% 0.062W
3676	4822 117 11817	1k2 1% 1/16W
3677	4822 051 30334	330k 5% 0.062W
3678	4822 117 11817	1k2 1% 1/16W
3679	4822 051 30334	330k 5% 0.062W
3680	4822 117 11817	1k2 1% 1/16W
3683	4822 051 30272	2k7 5% 0.062W
3684	3198 021 90030	JUMPER
3685	3198 021 90030	JUMPER
3688	3198 021 90030	JUMPER
3689	3198 021 90030	JUMPER
3702	4822 117 12139	22Ω 5% 0.062W
3703	4822 051 30101	100Ω 5% 0.062W
3705	4822 051 30101	100Ω 5% 0.062W
3706	4822 051 30109	10Ω 5% 0.062W
3707	4822 051 30392	3k9 5% 0.063W
3708	4822 051 30272	2k7 5% 0.062W
3709	3198 021 90030	JUMPER
3710	4822 051 30391	390Ω 5% 0.062W
3711	4822 051 30102	1k 5% 0.062W
3712	4822 051 30391	390Ω 5% 0.062W
3713	4822 051 30391	390Ω 5% 0.062W
3714	4822 117 12139	22Ω 5% 0.062W
3716	4822 051 30472	4k7 5% 0.062W
3717	4822 051 30472	4k7 5% 0.062W
3718	4822 051 30221	220Ω 5% 0.062W
3719	4822 117 13574	1Ω5 5% 1206
3720	4822 117 13574	1Ω5 5% 1206
3721	4822 117 13572	22Ω 5% 1206
3722	4822 117 13572	22Ω 5% 1206
3725	4822 051 30105	1M 5% 0.062W
3728	4822 051 30101	100Ω 5% 0.062W
3731	4822 051 30101	100Ω 5% 0.062W
3732	4822 051 10102	1k 2% 0.25W
3733	4822 051 30101	100Ω 5% 0.062W
3739	4822 051 30101	100Ω 5% 0.062W
3740	3198 021 90030	JUMPER
3741	4822 051 30102	1k 5% 0.062W
3744	4822 051 30102	1k 5% 0.062W
3745	4822 051 30102	1k 5% 0.062W
3746	4822 051 30472	4k7 5% 0.062W
3747	4822 051 30689	68Ω 5%
3748	4822 051 30689	68Ω 5%
3749	4822 051 30689	68Ω 5% 0.063W
3754	4822 051 30109	10Ω 5% 0.062W
3755	3198 021 90030	JUMPER
3757	3198 021 90030	JUMPER
3759	3198 021 90030	JUMPER
3790	4822 117 13522	100Ω 5% 0.63W
3791	4822 117 13522	100Ω 5% 0.63W
3792	4822 117 13522	100Ω 5% 0.63W
3793	4822 117 12662	10Ω 5%
3793	4822 117 13522	100Ω 5% 0.63W
3794	4822 117 12662	10Ω 5%
3794	4822 117 13522	100Ω 5% 0.63W
3795	4822 117 12662	10Ω 5%
3795	4822 117 13522	100Ω 5% 0.63W
3796	4822 051 30101	100Ω 5% 0.062W
3796	4822 051 30109	10Ω 5% 0.062W
3797	4822 051 30101	100Ω 5% 0.062W
3900	4822 051 30221	220Ω 5% 0.062W
3901	4822 051 30221	220Ω 5% 0.062W
3903	4822 051 30221	220Ω 5% 0.062W
3905	4822 051 30221	220Ω 5% 0.062W
3906	4822 051 30101	100Ω 5% 0.062W
3907	4822 051 30221	220Ω 5% 0.062W
3909	4822 051 30221	220Ω 5% 0.062W
3910	4822 051 30221	220Ω 5% 0.062W
3911	4822 051 30101	100Ω 5% 0.062W

5301	4822 157 11876	6.8µH 10%
5302	4822 157 11876	6.8µH 10%
5403	2422 549 44461	IND VAR 40mH
5404	2422 535 95427	100mH
5405	2422 535 95427	IND FXD 100mHz 120R
5406	3198 018 33980	3U9 10%
5407	3198 018 56880	6U8 10%
5408	2422 549 44459	IND VAR 78mH
5409	3198 018 51080	1U 10%
5410	3198 018 33370	0U33 10%
5651	2422 549 43769	100mH
5652	2422 549 43769	100mH
5653	2422 549 43769	100mH
5654	4822 157 11716	BLM21P300SPT
5701	4822 157 71206	BLM21A601SPT
5702	2422 535 95427	100mH
5703	4822 157 11716	BLM21P300SPT
5704	4822 157 11716	BLM21P300SPT
5705	2422 535 95427	100mH
5706	4822 157 11778	5U6 10%
5707	4822 157 11781	BLM11A601SPT1
5708	4822 157 11778	5U6 10%
5709	4822 157 11778	5U6 10%
5710	4822 157 11778	5U6 10%
5711	4822 157 11781	BLM11A601SPT1
5713	4822 157 11781	BLM11A601SPT1
5718	3198 018 33370	0U33 10%
5720	4822 157 11781	BLM11A601SPT1
5910	4822 157 11781	BLM11A601SPT1

6001	4822 130 11528	1PS76SB10
6003	4822 130 11528	1PS76SB10
6303	4822 130 11594	BZX284-C47
6304	4822 130 83757	BAS216
6306	9322 129 37685	BZM55-C5V6
6307	4822 130 11528	1PS76SB10
6309	4822 130 83757	BAS216
6310	9322 129 38685	BZM55-C6V8
6311	9322 149 08685	BZM55-C22
6319	4822 130 83757	BAS216
6334	4822 130 83757	BAS216
6403	4822 130 10414	BA792
6652	9322 129 40685	BZM55-C10
6653	4822 130 83757	BAS216

7001	9352 629 88557	SAA5801/011 V30
7002	5322 130 42756	BC857C
7003	3198 010 42310	BC847BW
7004	3198 010 42310	BC847BW
7005	9322 116 74668	LD1117D33
7006	3104 317 42211	SOFTW.ASSY 310431702211
7007	9322 136 53668	MSM51V18165D-60JS
7008	3198 010 42310	BC847BW
7009	3198 010 42310	BC847BW
7010	5322 130 42756	BC857C
7011	4822 209 17377	M24C32-WMN6/PROG
7301	9352 625 23518	TDA9330H/N2
7303	5322 130 42756	BC857C
7308	9340 310 30215	PDTC144ET
7309	9340 310 30215	PDTC144ET
7310	9340 310 30215	PDTC144ET
7311	3198 010 42310	BC847BW
7312	3198 010 42310	BC847BW
7320	3198 010 42310	BC847BW
7322	3198 010 42310	BC847BW
7323	9352 625 24518	TDA9321H/N2

7324	5322 130 63679	BC847CW
7403	4822 130 60511	BC847B
7407	4822 130 60373	BC856B
7411	4822 130 60511	BC847B
7651	9322 143 53671	MSP3415D-FH-B3
7651	9322 149 63671	MSP3451G-FH-A1
7652	9351 874 90118	74HC4052PW
7656	9340 425 20115	BC847BS
7658	9340 425 20115	BC847BS
7663	9340 425 20115	BC847BS
7674	3198 010 42310	BC847BW
7675	9351 874 90118	74HC4052PW
7680	3198 010 42310	BC847BW
7681	3198 010 42310	BC847BW
7701	5322 130 42756	BC857C
7702	3198 010 42310	BC847BW
7704	4822 209 73852	PMBT2369
7708	4822 209 90034	SAA4990H/V0
7709	9352 640 20557	SAA4978H/V203
7713	9322 116 74668	LD1117D33
7714	4822 209 17307	MSM54V12222A-30JS
7715	4822 209 17307	MSM54V12222A-30JS
7716	2422 486 80737	IC SOCKET 32P

Main Switch Panel [E]

Various

0151	4822 256 91766	LED HOLDER
0201	2422 025 16268	2P MALE
0202	2422 025 16374	2P MALE
0923	2412 020 00724	2P MALE
0947	4822 267 10734	5P MALE
1910	4822 130 91478	IR RECEIVER
1951	4822 276 14024	2P 4/128A

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2930	4822 124 41584	100µF 20% 10V

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3957	4822 053 21335	3M3 5% 0.5W
3966	4822 053 21335	3M3 5% 0.5W
3978	4822 051 20101	100Ω 5% 0.1W
3982	4822 117 13577	330Ω 1% 1.25W

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6901	4822 130 10859	TLDR5400

CRT Panel [F]

Various

0298	2422 500 80052	9P FEMALE
0340	3104 311 02321	CABLE 11P 400mm
0383	2422 025 16382	3P MALE

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2300	4822 124 40764	22µF 100 V
2301	4822 124 40196	220µF 20% 16V
2302	5322 122 32286	3.3pF 5% 50V
2303	5322 122 32268	470pF 10% 50V
2304	4822 121 41856	22nF 5% 250V
2305	4822 124 41751	47µF 20% 50V
2306	4822 126 14585	100nF 10% 50V
2307	5322 122 32654	22nF 10% 63V
2308	4822 126 13486	15pF 2% 63V
2309	5322 122 32654	22nF 10% 63V
2310	4822 126 13689	18pF 1% 63V
2312	5322 122 32658	22pF 5% 50V
2313	4822 124 11565	10µF 20% 250V
2316	4822 121 40518	100nF 10% 250V
2317	5322 121 44356	4.7nF 5% 2KV
2318	5322 122 32654	22nF 10% 63V
2320	4822 126 13838	100nF 20% 50V
2321	5322 122 32531	100pF 5% 50V
2322	5322 122 32531	100pF 5% 50V
2323	5322 122 32531	100pF 5% 50V
2325	4822 126 14585	100nF 10% 50V

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3300	4822 052 10109	10Ω 5% 0.33W
3301	4822 053 12103	10k 5% 3W
3302	4822 051 20182	1k8 5% 0.1W
3303	4822 117 10965	18k 1% 0.1W
3304	4822 117 11454	820Ω 1% 0.1W
3305	4822 117 13577	330Ω 1% 1.25W
3306	4822 051 20478	4Ω7 5% 0.1W
3307	4822 051 20109	10Ω 5% 0.1W
3308	4822 117 11148	56k 1% 0.1W
3309	4822 117 10353	150Ω 1% 0.1W
3310	4822 051 10102	1k 2% 0.25W
3311	4822 051 20101	100Ω 5% 0.1W
3312	4822 117 11449	2k2 1% 0.1W
3313	4822 116 83872	220Ω 5% 0.5W
3314	4822 116 83872	220Ω 5% 0.5W
3315	4822 117 11139	1k5 1% 0.1W
3316	4822 117 11148	56k 1% 0.1W
3317	4822 051 20122	1k2 5% 0.1W
3318	4822 051 20159	15Ω 5% 0.1W
3319	4822 117 11454	820Ω 1% 0.1W
3320	4822 051 10102	1k 2% 0.25W
3334	4822 050 11002	1k 1% 0.4W
3335	4822 051 10102	1k 2% 0.25W
3336	4822 051 10102	1k 2% 0.25W
3337	4822 051 10102	1k 2% 0.25W
3338	3198 013 01020	1k 2% 1/2W
3339	3198 013 01020	1k 2% 1/2W
3340	3198 013 01020	1k 2% 1/2W
3341	4822 052 10151	150Ω 5% 0.33W
3342	4822 051 20471	470Ω 5% 0.1W
3344	4822 116 52191	33Ω 5% 0.5W
3345	4822 116 52191	33Ω 5% 0.5W
3347	3198 013 01520	1k5 2% 1/2W
3348	4822 050 11204	120k 1% 0.4W
3349	3198 013 01020	1k 2% 1/2W
3350	4822 116 83883	470Ω 5% 0.5W
3351	4822 116 83883	470Ω 5% 0.5W
3352	4822 116 83883	470Ω 5% 0.5W
3354	4822 117 11449	2k2 1% 0.1W
3355	4822 051 20478	4Ω7 5% 0.1W
3356	4822 051 10102	1k 2% 0.25W
3357	4822 051 20478	4Ω7 5% 0.1W
4xxx	4822 051 10008	0Ω 5% 0.25W
4xxx	4822 051 20008	0Ω 5% 0.25W

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5300	2422 531 98035	TFM S13974-01 Y

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6305	4822 130 30842	BAV21
6306	4822 130 30842	BAV21
6307	4822 130 30842	BAV21
6310	4822 130 83757	BAS216

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7300	4822 130 44154	BF199
7301	4822 130 42589	BF370
7302	5322 130 41888	BD140-16
7303	5322 130 41886	BD139-16
7307	9352 561 40112	TDA6108
8317	3104 311 01901	CABLE 2P 560mm
8325	3104 311 01911	CABLE 3P 680mm

Side I/O Panel [O]

Various

0900	2422 026 04926	4P FEMALE
0901	4822 267 10975	3P
0902	4822 267 31014	HEADPHONE SOCKET
0936	2422 025 12485	11P MALE

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2905	4822 122 33177	10nF 20% 50V
2906	4822 122 33177	10nF 20% 50V

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3901	4822 051 20101	100Ω 5% 0.1W
3902	4822 116 52201	75Ω 5% 0.5W
3903	4822 051 20101	100Ω 5% 0.1W
3904	4822 116 52201	75Ω 5% 0.5W
3905	4822 050 11002	1k 1% 0.4W
3906	4822 050 11002	1k 1% 0.4W
3907	4822 117 10834	47k 1% 0.1W
3908	4822 050 11002	1k 1% 0.4W
3909	4822 117 10834	47k 1% 0.1W
3910	4822 116 52276	3k9 5% 0.5W
3911	4822 050 21003	10k 1% 0.6W
3912	4822 050 21003	10k 1% 0.6W

Top Control Panel [P]

Various

0345	4822 267 10748	3P MALE
1701	4822 276 13775	SWITCH
1702	4822 276 13775	SWITCH
1703	4822 276 13775	SWITCH
1704	4822 276 13775	SWITCH
1705	4822 276 13775	SWITCH

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3701	4822 051 20391	390Ω 5% 0.1W
3702	4822 117 13528	200Ω 1% 0.125W
3703	4822 117 10845	620Ω 1% 0.1W
3704	4822 117 11534	1k1 1% 0.1W
3705	4822 117 11951	2k 1% 0.1W
3999	4822 051 10102	1k 2% 0.25W